GROUND-WATER CONDITIONS IN UTAH, SPRING OF 2000

By

C.B. Burden and others

U.S. Geological Survey

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CONVERSION FACTORS

Multiply	By	To obtain
acre-foot	1,233	cubic meter
foot	0.3048	meter
gallon per minute	0.06308	liter per second
inch	25.4	millimeter
mile	1.609	kilometer
square mile	2.590	square kilometer

Chemical concentration is reported only in metric units—milligrams per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million.

DEFINITION OF TERMS

Acre-foot—The quantity of water required to cover 1 acre to a depth of 1 foot; equal to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Aquifer—A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield substantial amounts of water to wells and springs.

Artesian—Describes a well in which the water level stands above the top of the aquifer tapped by the well (confined). A flowing artesian well is one in which the water level is above the land surface.

Dissolved—Material in a representative water sample that passes through a 0.45–micrometer membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Land-surface datum (lsd)—A datum plane that is approximately at land surface at each ground-water observation well.

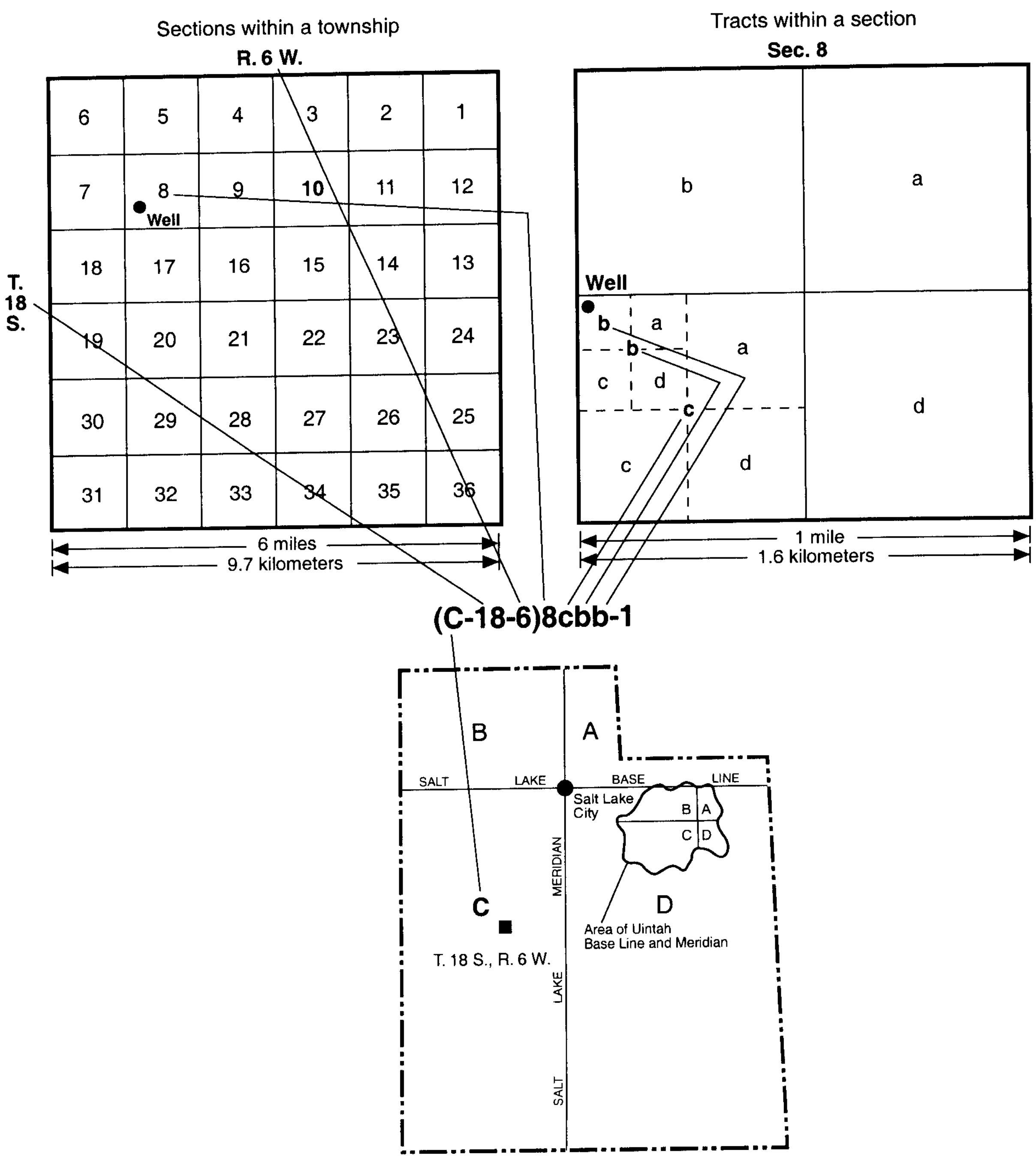
Milligrams per liter—A unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water.

Specific conductance—A measure of the ability of water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25 degrees Celsius. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids concentration of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant in water from one well or stream to another, and it may vary for the same source with changes in the composition of the water.

Cumulative departure from average annual precipitation—A graph of the departure or difference between the average annual precipitation and the value of precipitation for each year, plotted cumulatively. A cumulative plot is generated by adding the departure from average precipitation for the current year to the sum of departure values for all previous years in the period of record. A positive departure, or greater-than-average precipitation, for a year results in a graph segment trending upward; a negative departure results in a graph segment trending downward. A generally downward-trending graph for a period of years represents a period of generally less-than-average precipitation, which commonly causes and corresponds with declining water levels in wells. Likewise, a generally upward-trending graph for a period of years represents a period of greater-than-average precipitation, which commonly causes and corresponds with rising water levels in wells. However, increases or decreases in withdrawals of ground water from wells also affect water levels and can change or eliminate the correlation between water levels in wells and the graph of cumulative departure from average precipitation.

WELL-NUMBERING SYSTEM

The well-numbering system used in Utah is based on the Bureau of Land Management's system of land subdivision. The well-numbering system is familiar to most water users in Utah, and the well number shows the location of the well by quadrant, township, range, section, and position within the section. Well numbers for most of the State are derived from the Salt Lake Base Line and the Salt Lake Meridian. Well numbers for wells located inside the area of the Uintah Base Line and Meridian are designated in the same manner as those based on the Salt Lake Base Line and Meridian, with the addition of the "U" preceding the parentheses. The numbering system is illustrated below.



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INTRODUCTION

This is the thirty-seventh in a series of annual reports that describe ground-water conditions in Utah. Reports in this series, published cooperatively by the U.S. Geological Survey and the Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights, provide data to enable interested parties to maintain awareness of changing ground-water conditions.

This report, like the others in the series, contains information on well construction, ground-water withdrawal from wells, water-level changes, precipitation, streamflow, and chemical quality of water. Information on well construction included in this report refers only to wells constructed for new appropriations of ground water. Supplementary data are included in reports of this series only for those years or areas which are important to a discussion of changing ground-water conditions and for which applicable data are available.

This report includes individual discussions of selected significant areas of ground-water development in the State for calendar year 1999. Most of the reported data were collected by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Divisions of Water Rights and Water Resources.

The following reports deal with ground water in the State and were printed by the U.S. Geological Survey or by cooperating agencies from May 1999 through April 2000:

Ground-water conditions in Utah, spring of 1999, by C.B. Burden, L.E. Spangler, and others, Utah Division of Water Resources Cooperative Investigations Report No. 40.

Ground-water resources of Tooele Valley, Tooele County, Utah, by D.D. Susong: USGS Fact Sheet 125-99.

Deep Aquifer Remediation Tools (DARTs): A new technology for ground-water remediation, by D.L. Naftz, and J.A. Davis: USGS Fact Sheet 156-99.

UTAH'S GROUND-WATER RESERVOIRS

Small amounts of ground water can be obtained from wells throughout most of Utah, but large amounts that are of suitable chemical quality for irrigation, public supply, or industrial use generally can be obtained only in specific areas. The areas of ground-water development discussed in this report are shown in figure 1 and listed in table 1. Relatively few wells outside of these areas yield large amounts of ground water of suitable chemical quality for the uses listed above, although some of the basins in western Utah and many areas in eastern Utah have not been explored sufficiently to determine their potential for ground-water development.

About 2 percent of the wells in Utah yield water from consolidated rock. Consolidated rocks that yield the most water are lava flows, such as basalt, which contain interconnected vesicular openings, fractures, or permeable weathered zones at the tops of flows; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains open fractures. Most of the wells that penetrate consolidated rock are in the eastern and southern parts of the State in areas where water cannot be obtained readily from unconsolidated deposits.

About 98 percent of the wells in Utah yield water from unconsolidated deposits. These deposits may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these materials. The largest yields are obtained from coarse materials that are sorted into deposits of uniform grain size. Most wells that yield water from unconsolidated deposits are in large intermountain basins that have been partly filled with rock material eroded from the adjacent mountains.

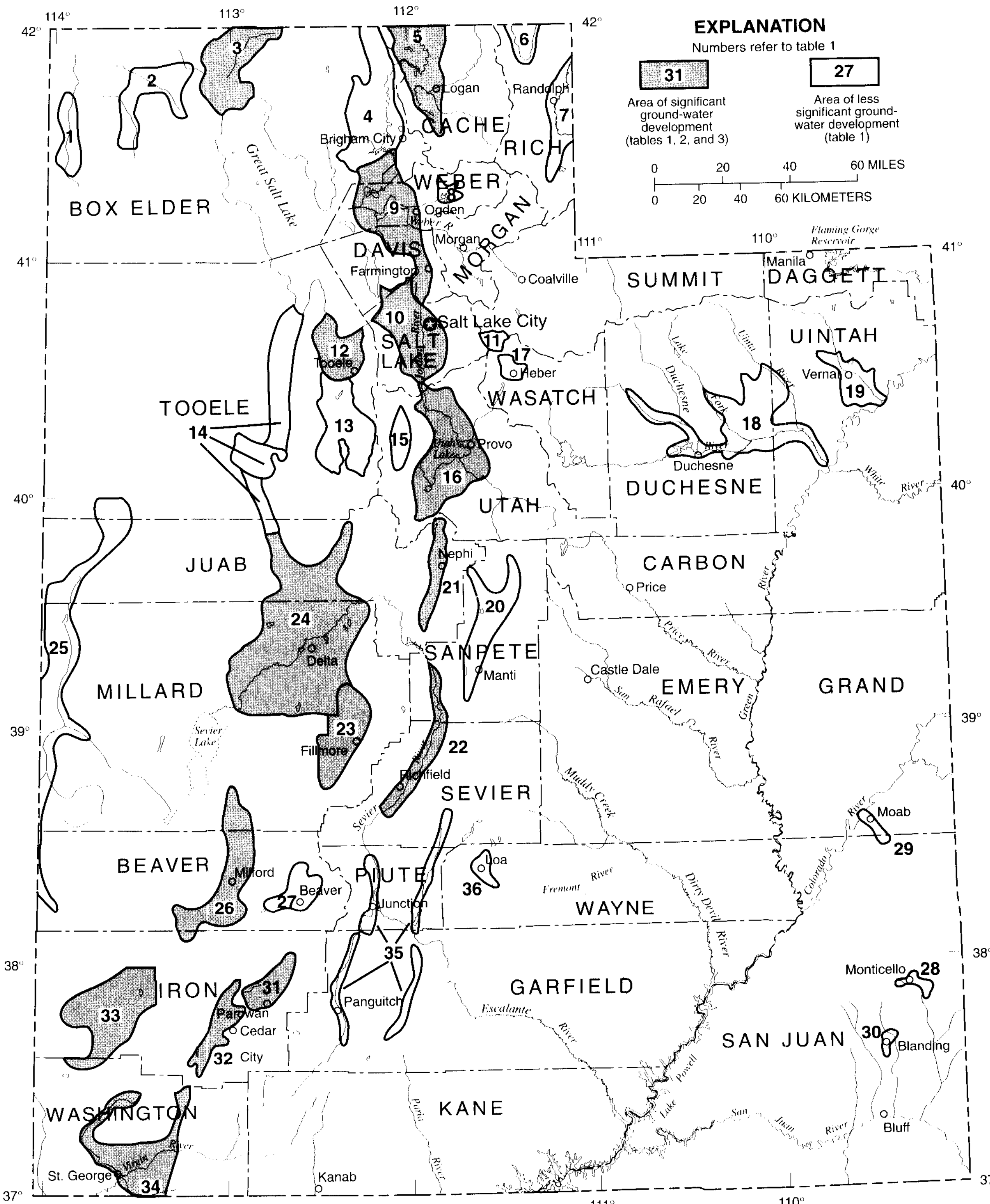


Figure 1. Areas of ground-water development in Utah specifically referred to in this report.

Table 1. Areas of ground-water development in Utah specifically referred to in this report

Number in figure 1	Area	Principal types of water-bearing rocks
1	Grouse Creek Valley	Unconsolidated.
2	Park Valley	Do.
3	Curlew Valley	Unconsolidated and consolidated.
4	Malad-lower Bear River Valley	Unconsolidated.
5	Cache Valley	Do.
6	Bear Lake Valley	Do.
7	Upper Bear River Valley	Do.
8	Ogden Valley	Do.
9	East Shore area	Do.
10	Salt Lake Valley	Do.
11	Park City area	Unconsolidated and consolidated.
12	Tooele Valley	Unconsolidated.
13	Rush Valley	Do.
14	Dugway area	Do.
	Skull Valley	Do.
	Old River Bed	Do.
15	Cedar Valley, Utah County	Do.
16	Utah and Goshen Valleys	Do.
17	Heber Valley	Do.
18	Duchesne River area	Unconsolidated and consolidated.
19	Vernal area	Do.
20	Sanpete Valley	Do.
21	Juab Valley	Unconsolidated.
22	Central Sevier Valley	Do.
23	Pahvant Valley	Unconsolidated and consolidated.
24	Sevier Desert	Unconsolidated.
25	Snake Valley	Do.
26	Milford area	Do.
27	Beaver Valley	Do.
28	Monticello area	Consolidated.
29	Spanish Valley	Unconsolidated and consolidated.
30	Blanding area	Consolidated.
31	Parowan Valley	Unconsolidated and consolidated.
32	Cedar Valley, Iron County	Unconsolidated.
33	Beryl-Enterprise area	Do.
34	Central Virgin River area	Unconsolidated and consolidated.
35	Upper Sevier Valleys	Unconsolidated.
36	Upper Fremont River Valley	Unconsolidated and consolidated.

SUMMARY OF CONDITIONS

The total estimated withdrawal of water from wells in Utah during 1999 was about 817,000 acre-feet (table 2), which is about 71,000 acre-feet more than the total for 1998 and 34,000 acre-feet less than the 1989-98 average annual withdrawal (table 3). The increase in withdrawals mostly resulted from increased irrigation and industrial usage. The total estimated withdrawal for irrigation was about 456,000 acre-feet (table 2), which is 27,000 acre-feet more than in 1998. Withdrawal for industrial use was about 71,000 acre-feet, which is about 10,000 acre-feet more than in 1998. Withdrawal for public supply increased about 26,000 acre-feet to about 220,000 acre-feet. Withdrawal for domestic and stock use was about 68,000 acre-feet, which is about 5,000 acre-feet more than in 1998.

Ground-water withdrawal increased from 1998 to 1999 in 10 of the 16 areas of ground-water development discussed in this report (table 2). Withdrawal in Utah and Goshen Valleys increased about 29,000 acre-feet, the largest increase among the significant ground-water development areas (fig. 1). The 1999 withdrawal was less than the average annual withdrawals for 1989-98 in 10 of the 16 areas (tables 2 and 3).

The amount of water withdrawn from wells is related to demand and availability of water from other sources, which, in turn, are partly related to local climatic conditions. Precipitation during calendar year 1999 at 22 of 29 weather stations included in this report (National Oceanic and Atmospheric Administration, 1999), was less than the long-term average. The greatest decline in precipitation from average in 1999 was the 5.45 inches recorded at Parowan Power Plant, and the greatest rise in precipitation from average was the 1.75 inches recorded at Monticello, in southeastern Utah.

A total of 724 wells were constructed for new appropriations of ground water in 1999, as determined by the Utah Division of Water Rights (table 2). This is 73 more wells than was reported for 1998. In 1999, 146 large-diameter wells (12 inches or more) were constructed for new appropriations of ground water (table 2). These are principally for withdrawal of water for public supply, irrigation, and industrial use.

Table 2. Number of wells constructed and estimated withdrawal of water from wells in Utah
Estimated withdrawal from wells—
1998 total: From Burden, Spangler, and others (1999, table 2).

Area	Number in figure 1	Number of wells[1] constructed in 1999		Estimated withdrawal from wells (acre-feet)					
				1999					1998
		Total	Diameter of 12 inches or more	Irrigation	Industry[1]	Public supply[1]	Domestic and stock	Total (rounded)	Total (rounded)
Curlew Valley	3	2	1	29,000	0	180	100	29,000	29,000
Cache Valley	5	45	7	10,700	7,000	4,800	2,000	24,000	26,000
East Shore area	9	10	2	24,300	3,800	27,700	5,000	61,000	56,000
Salt Lake Valley	10	15	5	2,600	[2]24,600	72,700	26,000	126,000	122,000
Tooele Valley	12	30	2	[3]15,700	900	4,000	810	21,000	[4]19,000
Utah and Goshen Valleys	16	55	3	43,000	10,300	41,200	20,200	115,000	86,000
Juab Valley	21	9	4	13,000	180	[5,6]30	400	14,000	12,000
Sevier Desert	24	16	6	5,400	3,800	1,400	1,200	12,000	12,000
Central Sevier Valley	22	[7]45	[7]1	15,500	180	1,900	2,000	20,000	20,000
Pahvant Valley	23	8	1	74,500	[8]530	680	100	76,000	66,000
Cedar Valley, Iron County	32	19	16	25,600	40	5,700	820	32,000	36,000
Parowan Valley	31	8	5	[9]32,900	0	80	280	33,000	28,000
Escalante Valley									
Milford area	26	2	0	31,800	[10]8,300	920	270	41,000	41,000
Beryl-Enterprise area	33	31	17	75,800	1,800	520	830	79,000	74,000
Central Virgin River area	34	11	5	2,400	150	25,500	250	28,000	20,000
Other areas[11,12]		418	71	54,300	12,100	32,800	7,400	106,000	99,000
Total (rounded)		724	146	456,000	74,000	220,000	68,000	817,000	[4]746,000

[1] Data provided by Utah Department of Natural Resources, Division of Water Rights.
[2] Includes some use for air conditioning, 3,630 acre-feet, of which about 70 percent was injected back into the aquifer.
[3] Includes some domestic and stock use.
[4] Revised.
[5] Includes some industrial use.
[6] Previously included some springs.
[7] Includes wells constructed in upper Sevier Valley and upper Fremont River Valley.
[8] Withdrawal for geothermal power generation. About 85 percent was injected back into the aquifer.
[9] Includes some stock use.
[10] Withdrawal for geothermal power generation. About 99 percent was injected back into the aquifer.
[11] Withdrawal totals are estimated minimum. See "Other areas" section of this report for withdrawal estimates for other areas.
[12] Includes withdrawals for upper Sevier Valley and upper Fremont River Valley that were included with central Sevier Valley in reports prior to number 31 of this series.

Table 3. Total annual withdrawal of water from wells in significant areas of ground-water development in Utah, 1989-98
[From previous reports of this series]

Area	Number in figure 1	Thousands of acre-feet										
		1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1989-98 average (rounded)
Curlew Valley	3	29	43	37	44	35	41	31	39	36	29	36
Cache Valley	5	30	32	29	36	23	31	23	24	25	26	28
East Shore area	9	61	65	68	59	56	60	53	57	62	56	60
Salt Lake Valley	10	157	143	135	138	116	142	120	138	123	122	133
Tooele Valley	12	27	33	30	30	22	31	26	23	25	[1]19	27
Utah and Goshen Valleys	16	121	129	124	141	89	114	77	99	96	86	108
Juab Valley	21	28	27	25	29	20	26	13	19	15	12	21
Sevier Desert	24	17	34	34	33	31	37	18	17	17	12	25
Central Sevier Valley[2]	22	18	18	18	19	19	20	20	21	20	20	19
Pahvant Valley	23	82	88	74	86	87	93	69	83	67	66	80
Cedar Valley, Iron County	32	28	30	34	34	33	34	31	35	34	36	33
Parowan Valley	31	29	31	32	31	28	30	24	29	25	28	29
Escalante Valley												
Milford area	26	46	48	54	42	50	61	48	52	52	41	49
Beryl-Enterprise area	33	85	86	79	72	78	86	70	92	81	74	80
Central Virgin River area	34	23	22	15	14	13	14	15	17	18	20	17
Other areas		100	111	111	120	94	113	97	113	107	99	106
Total		881	940	899	928	794	933	735	858	803	[1]746	851

[1] Revised.
[2] Prior to 1991, included upper Sevier and upper Fremont River Valleys.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CURLEW VALLEY

By J.D. Sory

The Curlew Valley drainage basin extends across the Utah-Idaho State line between latitude 40°41' and 42°30' north and longitude 112°30' and 113°20' west, and covers about 1,200 square miles. The valley is bounded on the west, north, and east by mountain ranges that range in altitude from about 6,500 to nearly 10,000 feet and is open to the south, where it drains into Great Salt Lake.

The Utah part of Curlew Valley (Utah subbasin) covers about 550 square miles. It is an arid to semiarid, largely uninhabited area, with a community center at Snowville. Average annual precipitation in the Utah subbasin is less than 8 inches on part of the valley floor and reaches a maximum that exceeds 35 inches on one of the highest mountain peaks.

The principal source of water in the Utah subbasin is the ground-water reservoir. Confined aquifers in alluvial and lacustrine deposits and intercalated volcanic rocks in the valley fill yield several hundred to several thousand gallons of water per minute to individual large-diameter irrigation wells west of Snowville and near Kelton.

Total estimated withdrawal of water from wells in Curlew Valley in 1999 was about 29,000 acre-feet, which is the same as reported for 1998 and 7,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells in Curlew Valley in which the water level was measured during March 2000 is shown in figure 2. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 3.

Water levels generally declined from March 1999 to March 2000 in Curlew Valley. Water levels during March generally rose from 1982 to 1987, a period of much-greater-than-average precipitation, and generally declined from 1987 to 2000. The decline in water level in the northern part of the valley probably resulted from continued withdrawal for irrigation and below-average precipitation.

Water-level data were insufficient to prepare a detailed contour map of water-level change from March 1970 to March 2000. However available data showed a decline in the north-central part of the valley and a rise in the northwest, northeast, and southwest parts (fig. 4).

Precipitation at Grouse Creek during 1999 was 8.72 inches, which is 7.46 inches less than in 1998 and 2.61 inches less than the average annual precipitation for 1959-99.

The concentrations of dissolved solids in water from well (B-14-9)5bbb-1, west of Snowville, and well (B-12-11)4bcc-1, north of Kelton, generally have increased since 1972. These increases may be a result of recharge from unconsumed irrigation water in which dissolved solids are concentrated by evaporation.

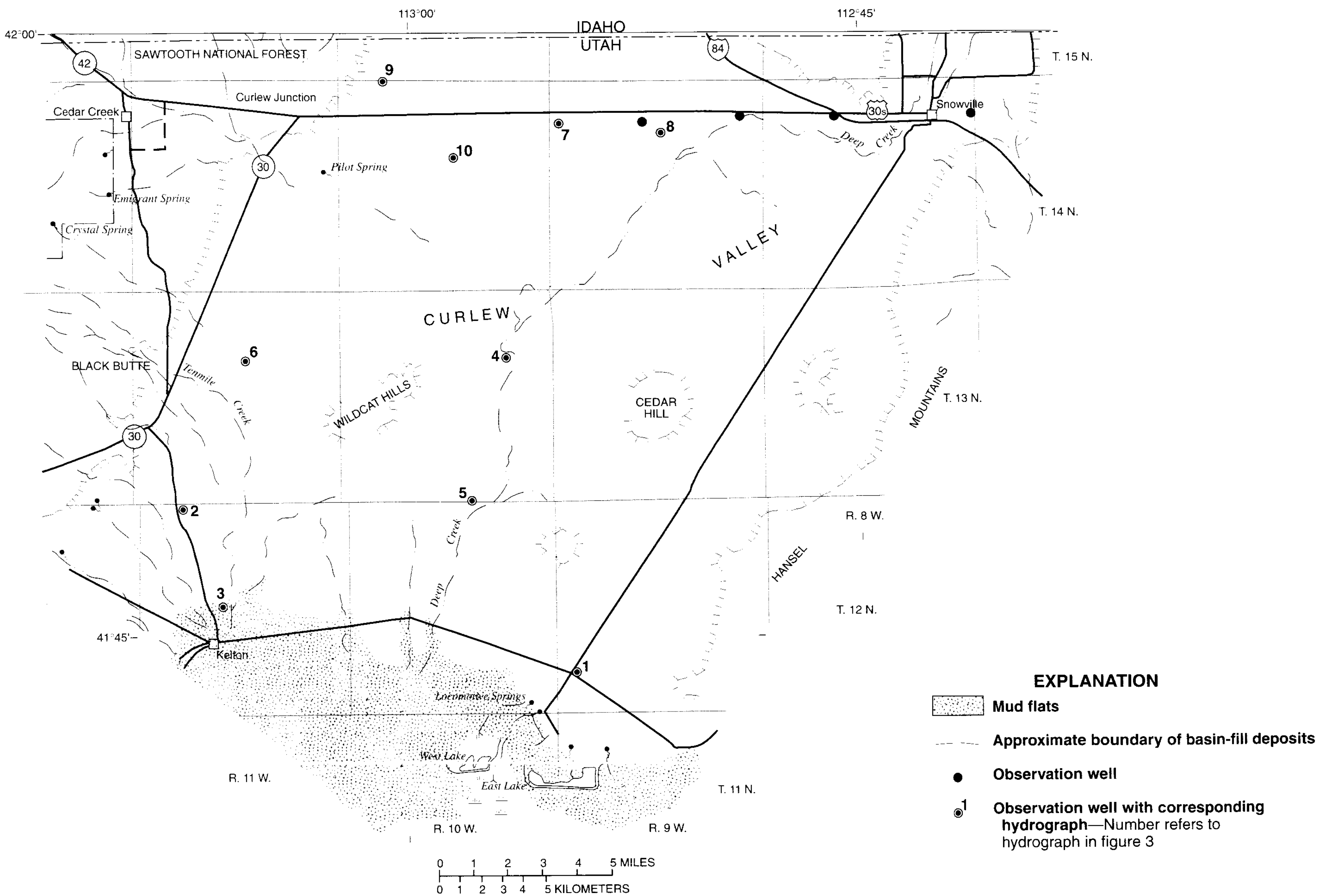


Figure 2. Location of wells in Curlew Valley in which the water level was measured during March 2000.

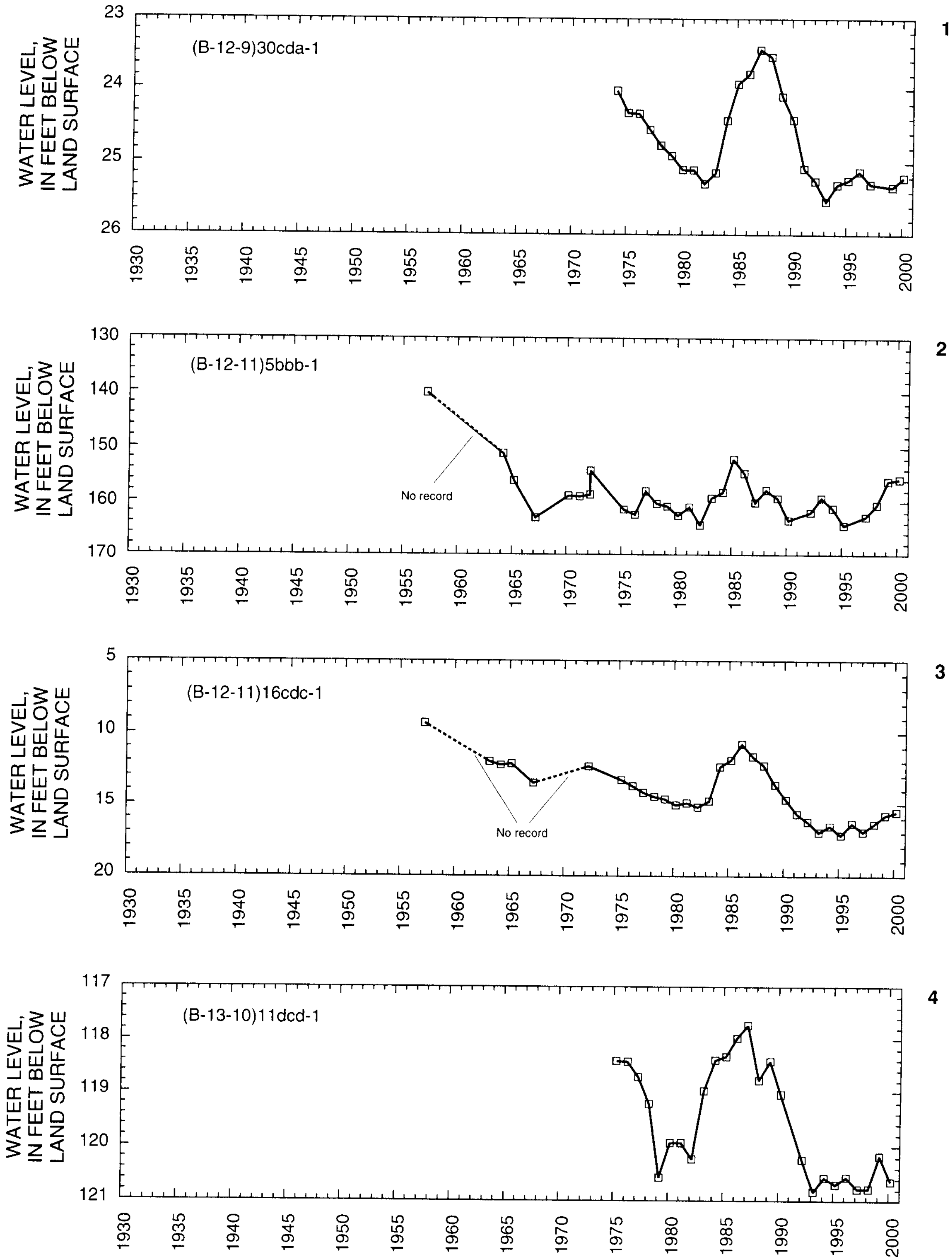


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

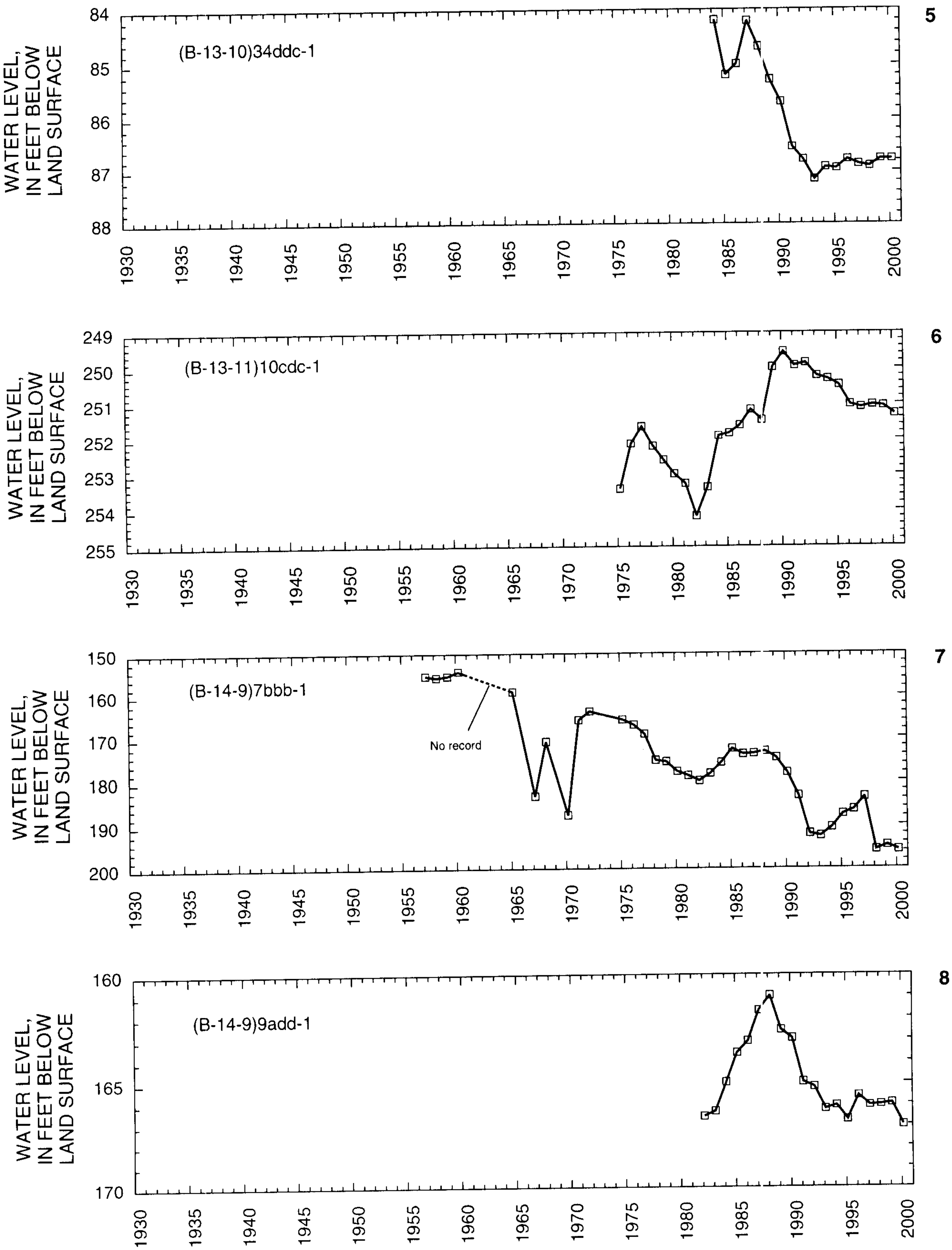
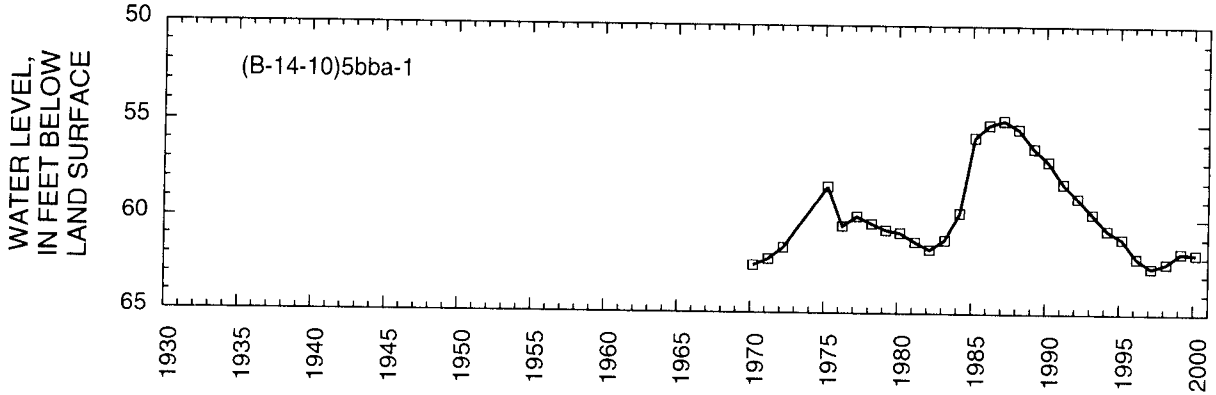


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells —Continued.



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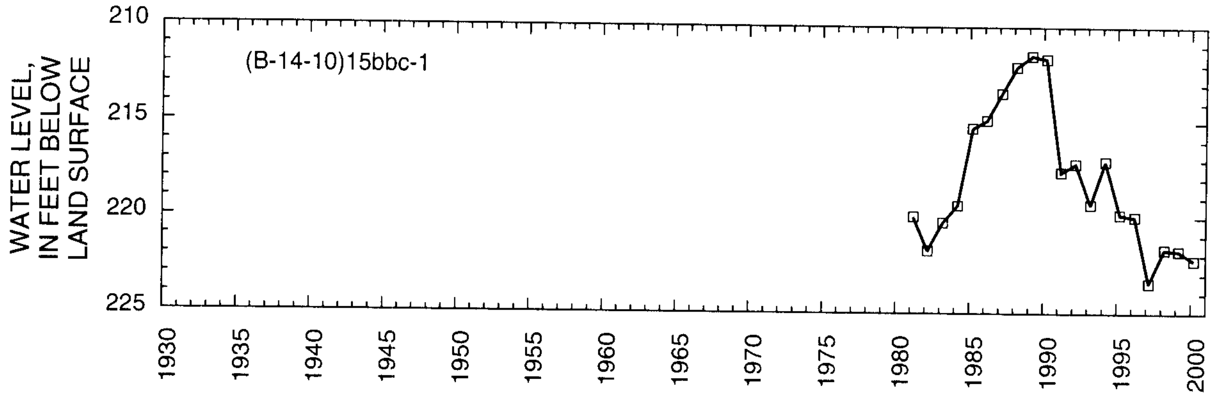

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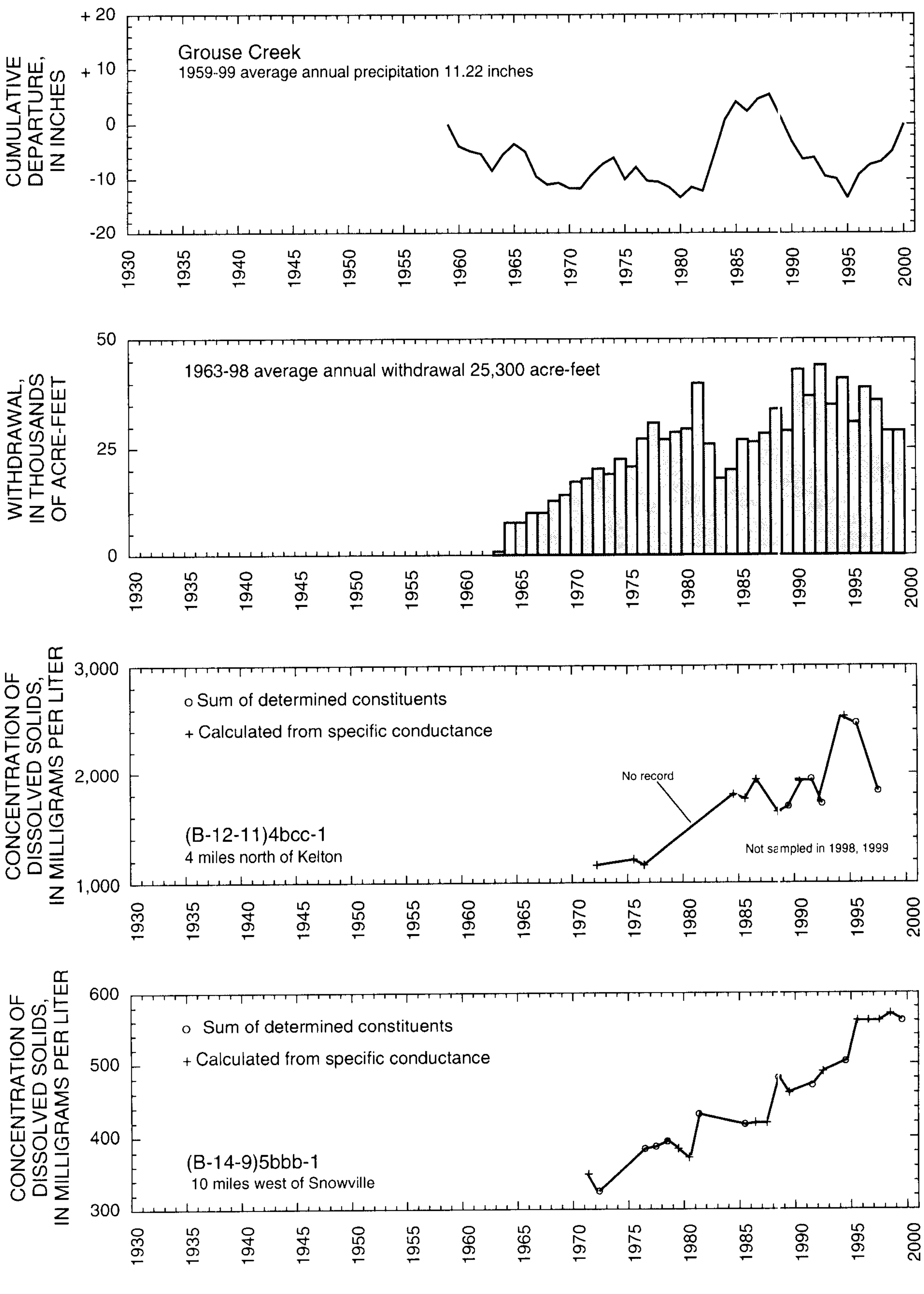

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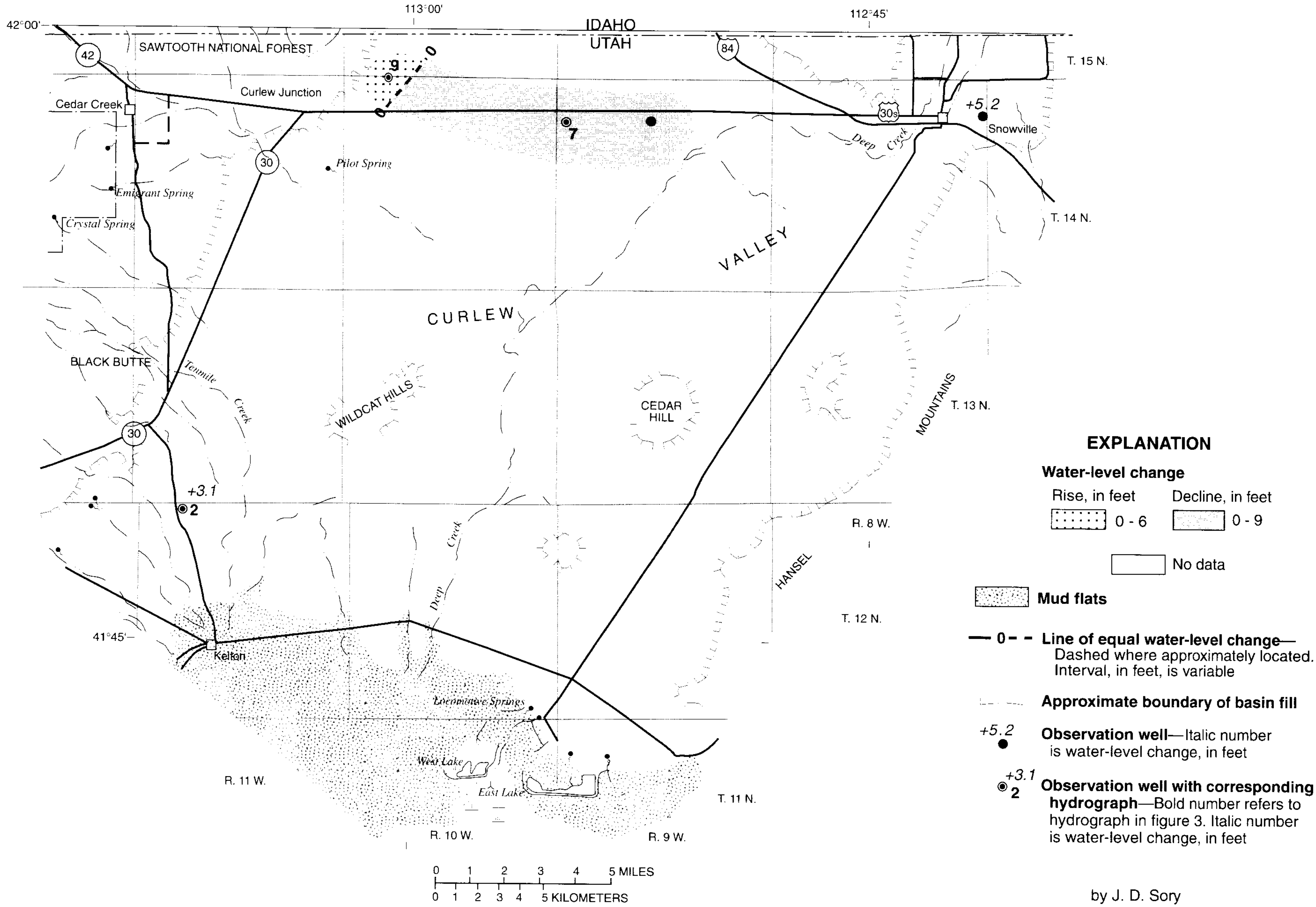


Figure 4. Map of Curlew Valley showing change of water level from March 1970 to March 2000.

CACHE VALLEY

By M.R. Danner

Cache Valley, as referred to in this report, covers about 450 square miles in Utah. Ground water occurs in unconsolidated deposits in the valley, under both water-table and artesian conditions. Recharge to the ground-water system occurs principally at the margins of the valley, and ground water moves toward the center of the valley and toward a point of discharge near Cache Junction.

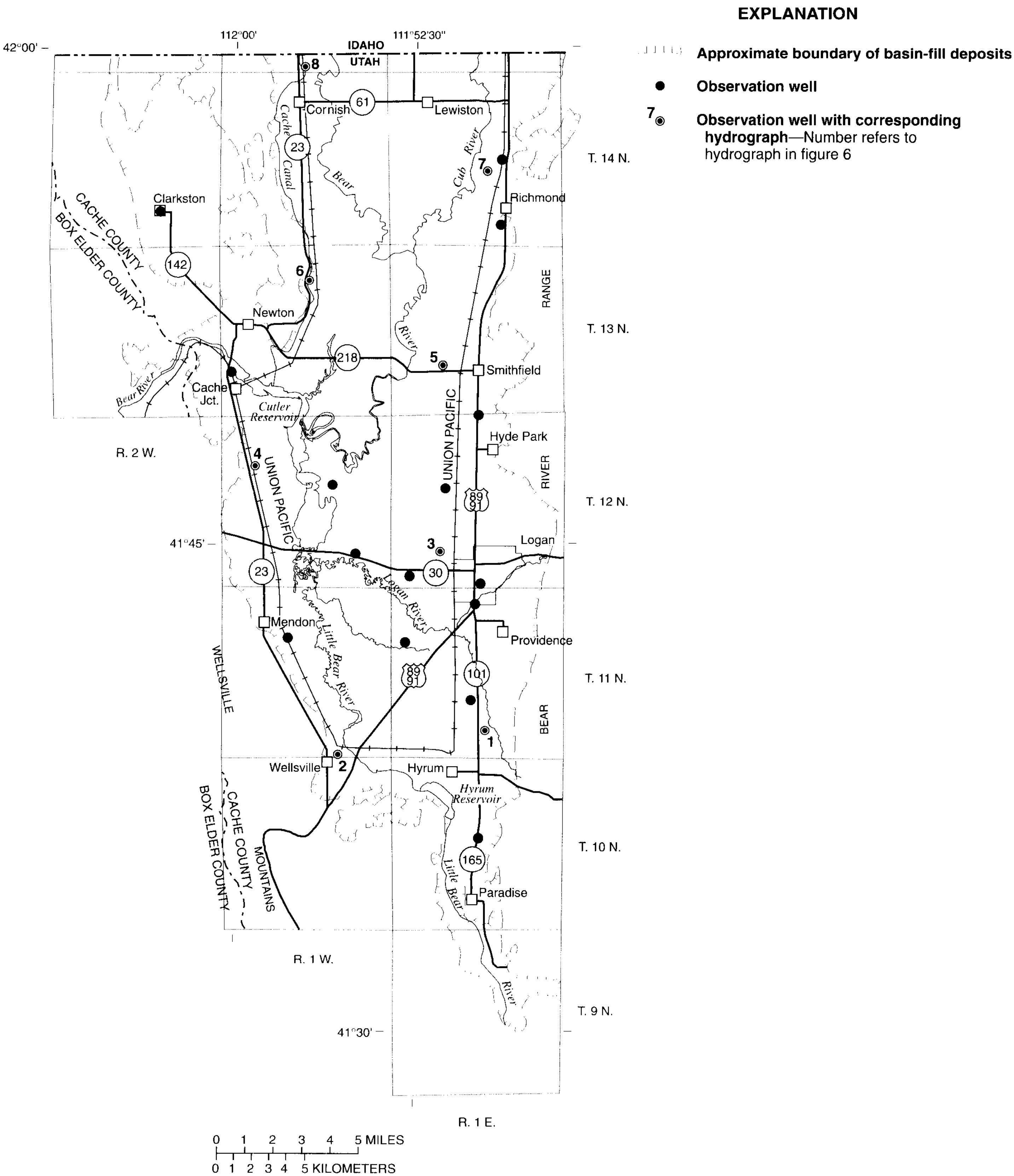
Total estimated withdrawal of water from wells in Cache Valley in 1999 was about 24,000 acre-feet, which is about 2,000 acre-feet less than was reported for 1998 and 4,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3). The decrease in withdrawals mostly resulted from decreases in irrigation use.

The location of wells in Cache Valley in which the water level was measured during March 2000 is shown in figure 5. The relation of the water level in selected wells to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1 is shown in figure 6. Although the water level in most observation wells declined from March 1999 to March 2000, water levels generally rose from about 1980 to 1985, corresponding to a period of greater-than-average precipitation, generally declined from 1985 to 1990, and generally have risen or remained stable since 1990.

Water levels declined in most of the Cache Valley from March 1970 to March 2000. The largest decline, about 13 feet, occurred south of Providence (fig. 7). Small rises, less than 1 foot, occurred near Mendon and north of Paradise.

Total discharge of the Logan River (combined flow from the Logan River above State Dam, near Logan, and Logan, Hyde Park, and Smithfield Canal at Head, near Logan) during 1999 was about 253,600 acre-feet, which is 19,200 acre-feet more than the revised 234,400 acre-feet of discharge during 1998 and 68,600 acre-feet more than the 1941-99 average annual discharge.

Precipitation at Logan, Utah State University, was 15.88 inches in 1999. This is 11.48 inches less than the precipitation reported for 1998 and 2.92 inches less than the average annual precipitation for 1941-99. The concentration of dissolved solids in water from well (A-13-1)29bcd-1 fluctuated during 1970-99 with no apparent trend.



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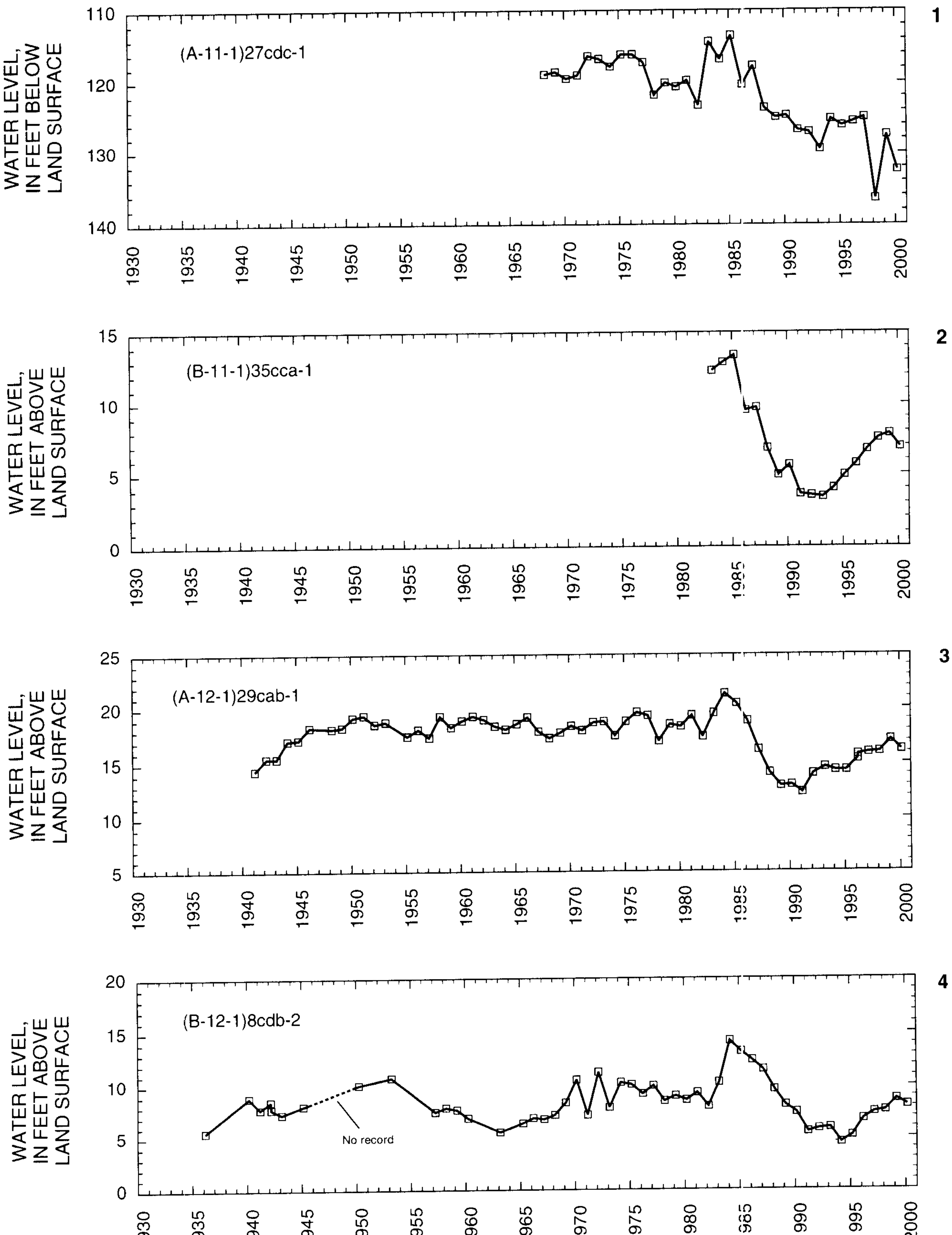
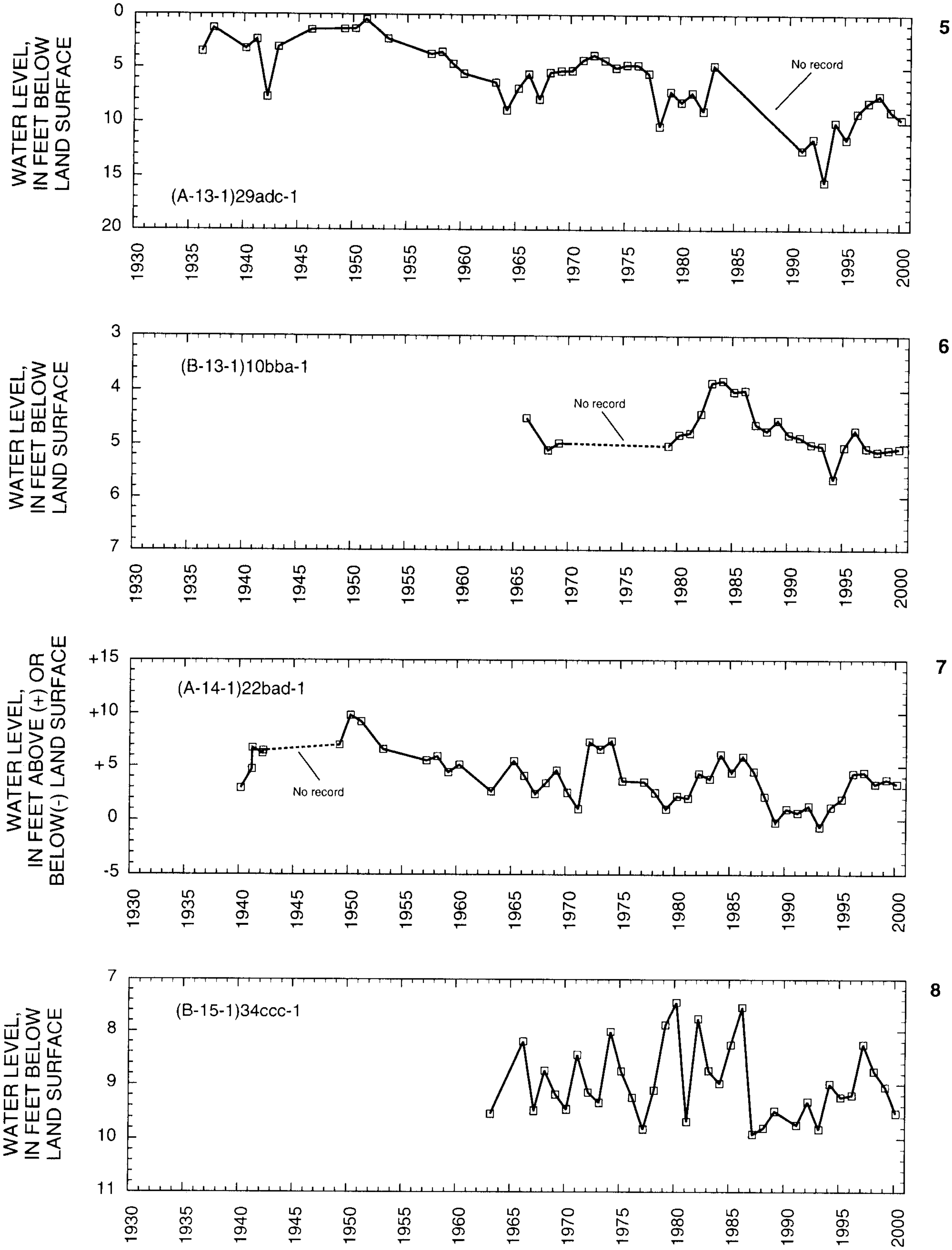


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.



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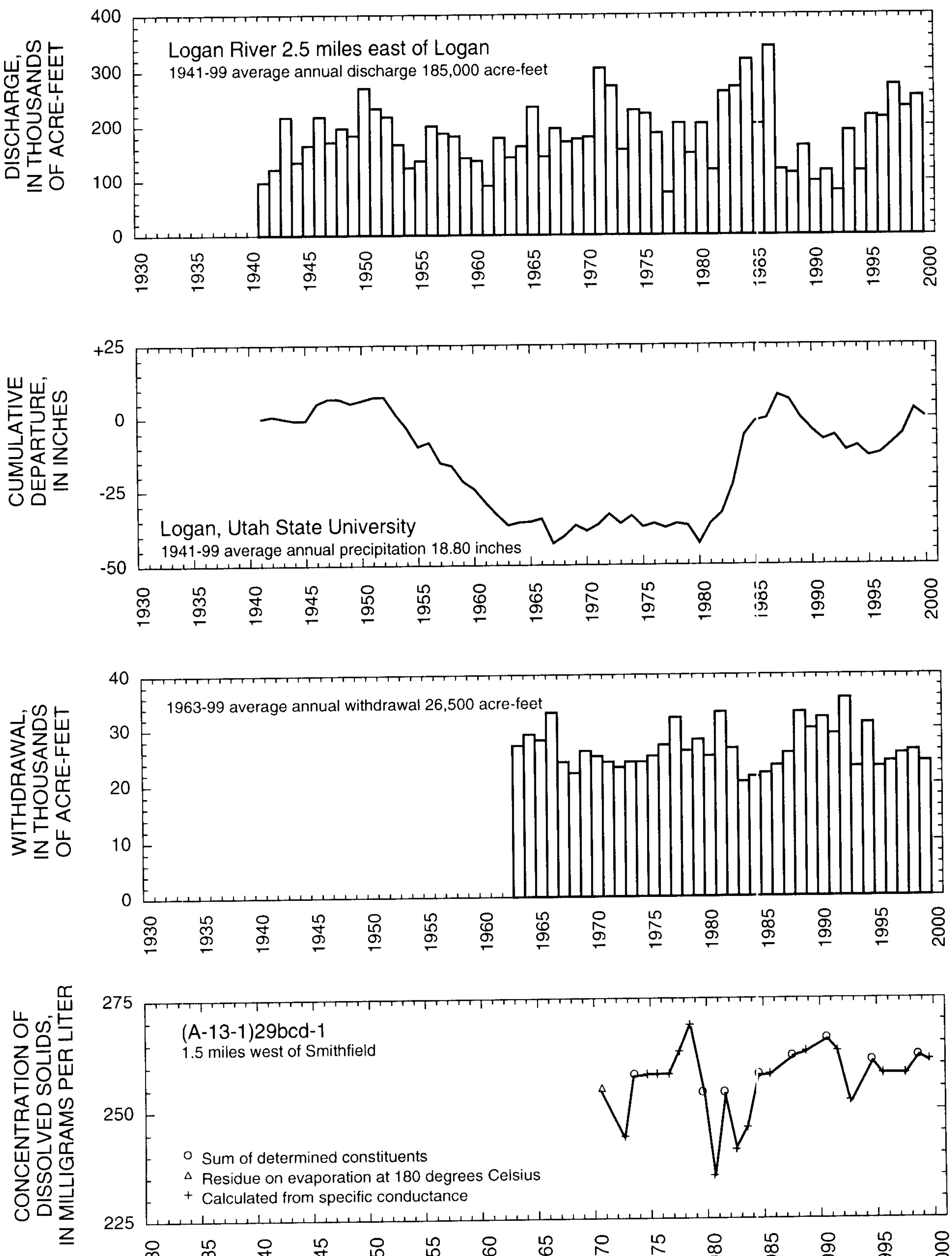

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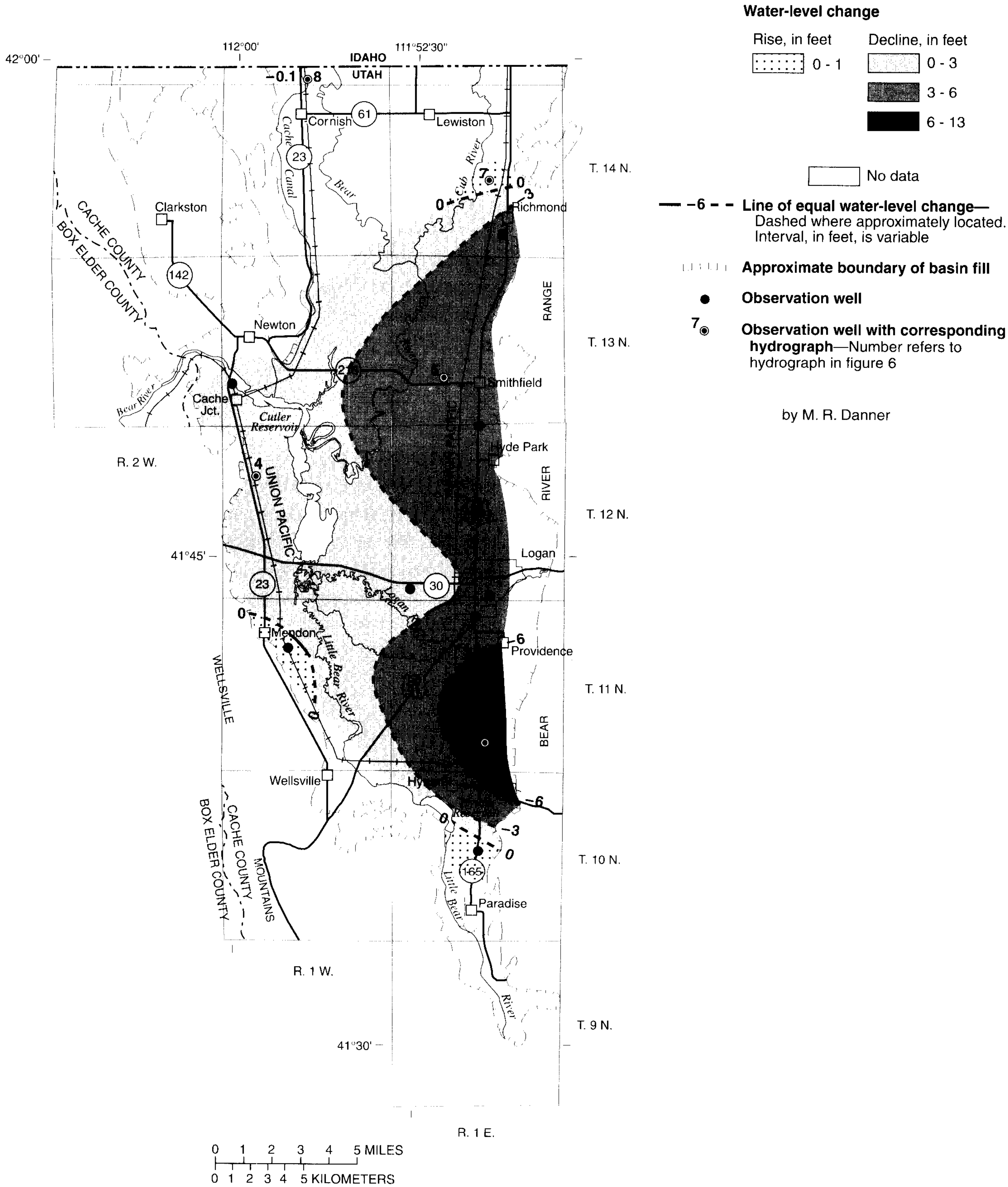


Figure 7. Map of Cache Valley showing change of water level from March 1970 to March 2000.

EAST SHORE AREA

By C.B. Burden

The East Shore area is in north-central Utah between the Wasatch Range and Great Salt Lake. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions, but most of the water is withdrawn by wells from the artesian aquifers. Water enters the artesian aquifers along the east edge of the Weber Delta and Bountiful area and generally moves westward toward Great Salt Lake.

Total estimated withdrawal of water from wells in the East Shore area in 1999 was about 61,000 acre-feet, which is 5,000 acre-feet more than was reported for 1998 and 1,000 acre-feet more than the average annual withdrawal for 1989-98 (tables 2 and 3). The increase in withdrawals mostly resulted from increased withdrawals for public supply. Withdrawal for public supply was about 27,700 acre-feet, which is about 3,800 acre-feet more than in 1998. Industrial withdrawal increased by about 500 acre-feet to 3,800 acre-feet, and irrigation withdrawal increased by about 300 acre-feet to 24,300 acre-feet from 1998 to 1999.

The location of wells in the East Shore area in which the water level was measured during March 2000 is shown in figure 8. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at the Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1 is shown in figure 9. Water levels in March in the southern part of the East Shore area generally declined from 1984 to 1989 and generally have risen since 1989, although levels generally declined from March 1999 to March 2000. Water levels in the western part of the East Shore area generally have declined since the 1950s. Declines probably resulted from continued large withdrawal for public supply. Precipitation at the Ogden Pioneer Powerhouse in 1999 was 18.71 inches, which is 3.14 inches less than the average annual precipitation for 1937-99, and 11.01 inches less than in 1998.

Water levels generally declined from March 1970 to March 2000 in most of the East Shore area. The largest decline, 30.8 feet, occurred in a well south of Ogden (fig. 10). The decline in water levels is probably the result of increased withdrawals for public supply. Rises in water levels occurred along the southern edge of the area and in a small area west of Syracuse. Rises were probably the result of decreased local pumpage.

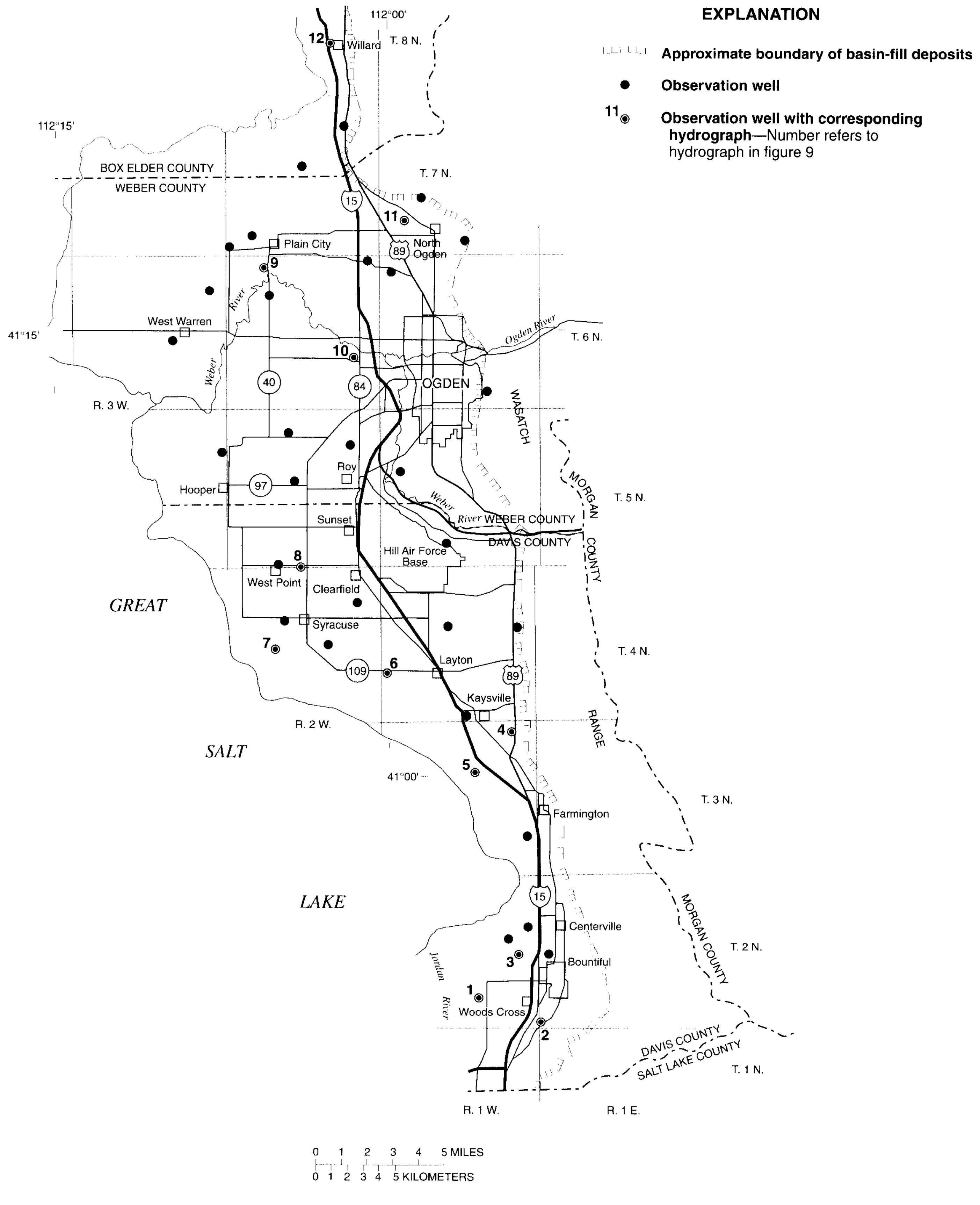


Figure 8. Location of wells in the East Shore area in which the water level was measured during March 2000.

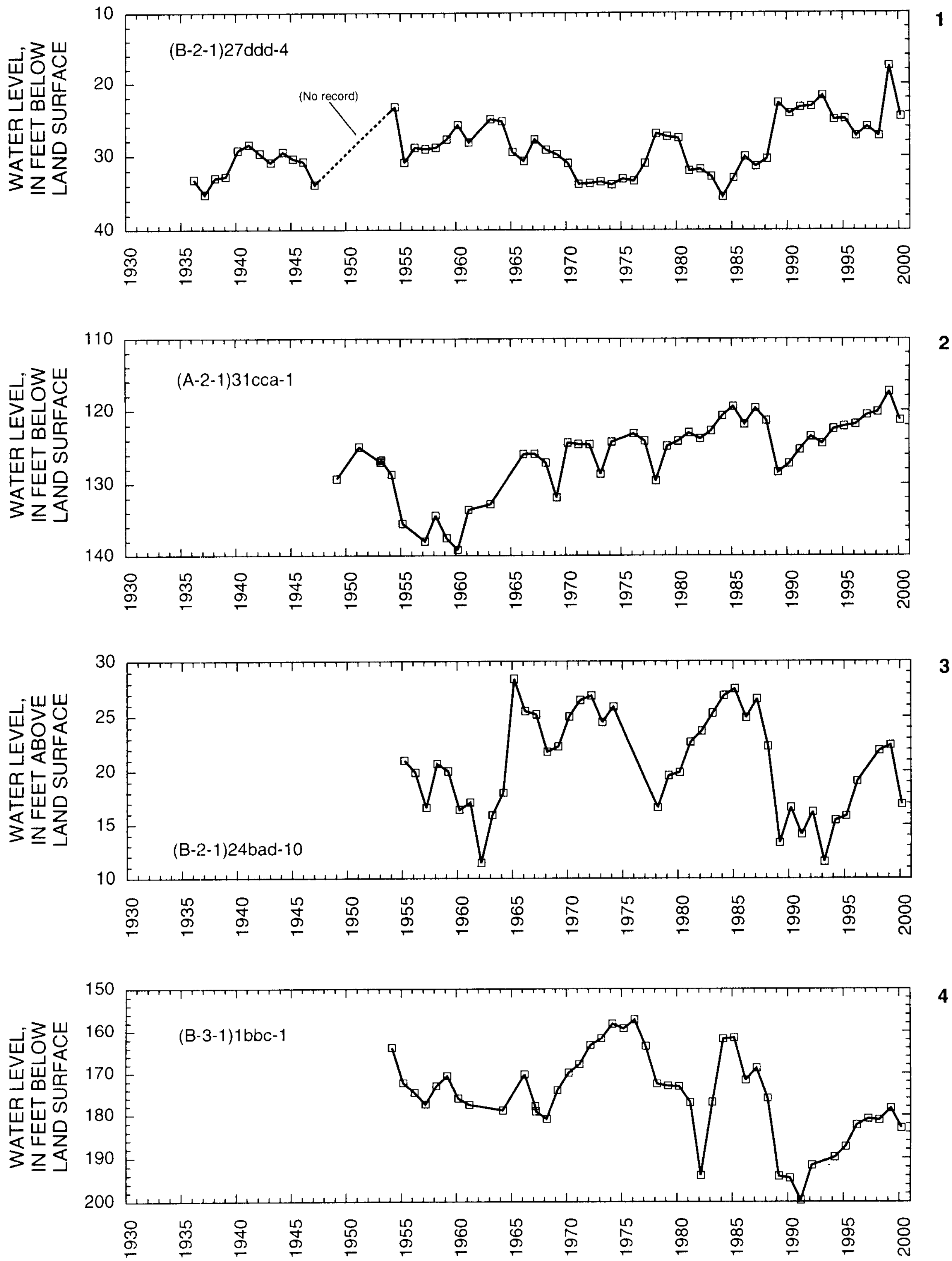


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.

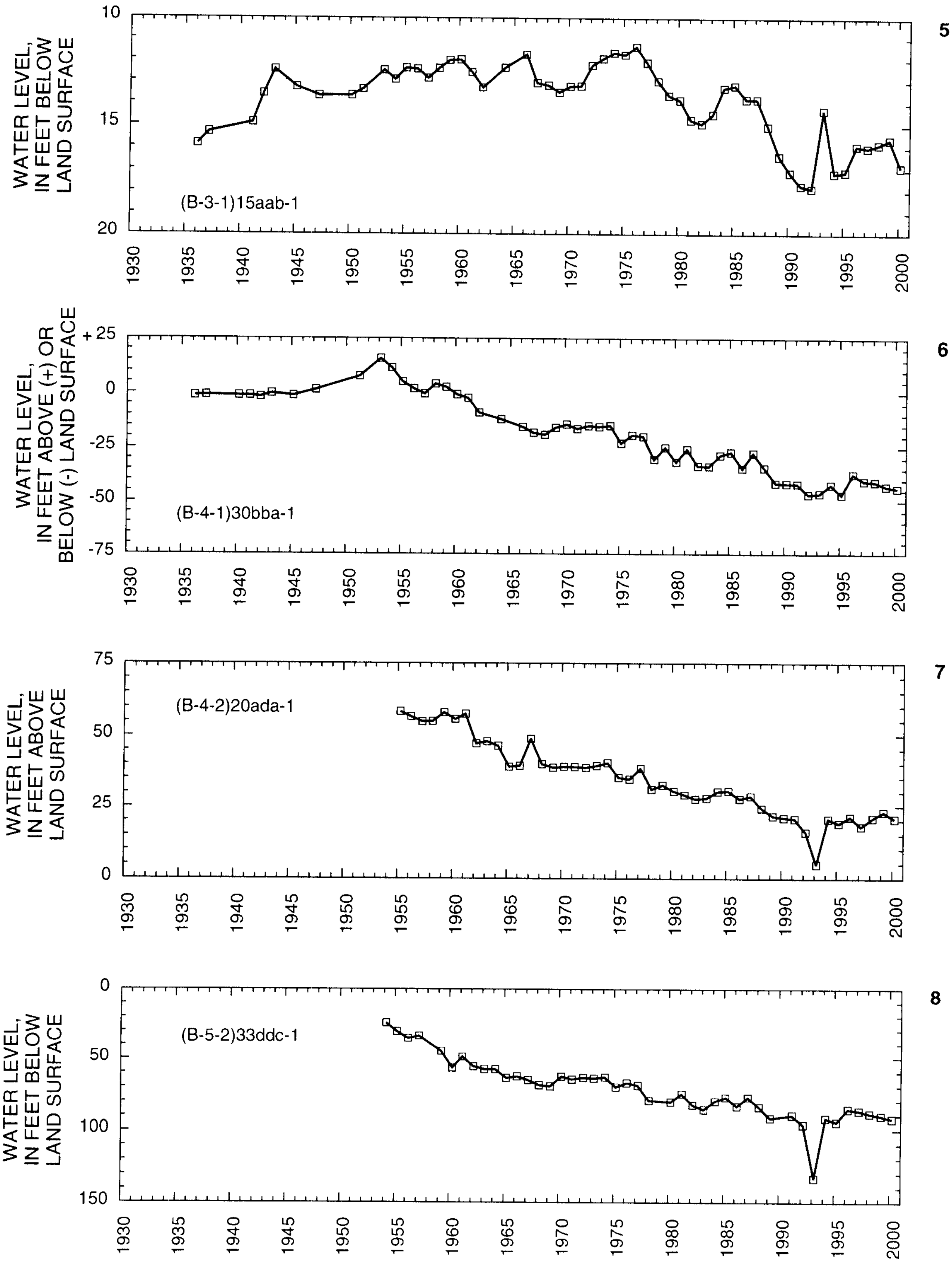


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

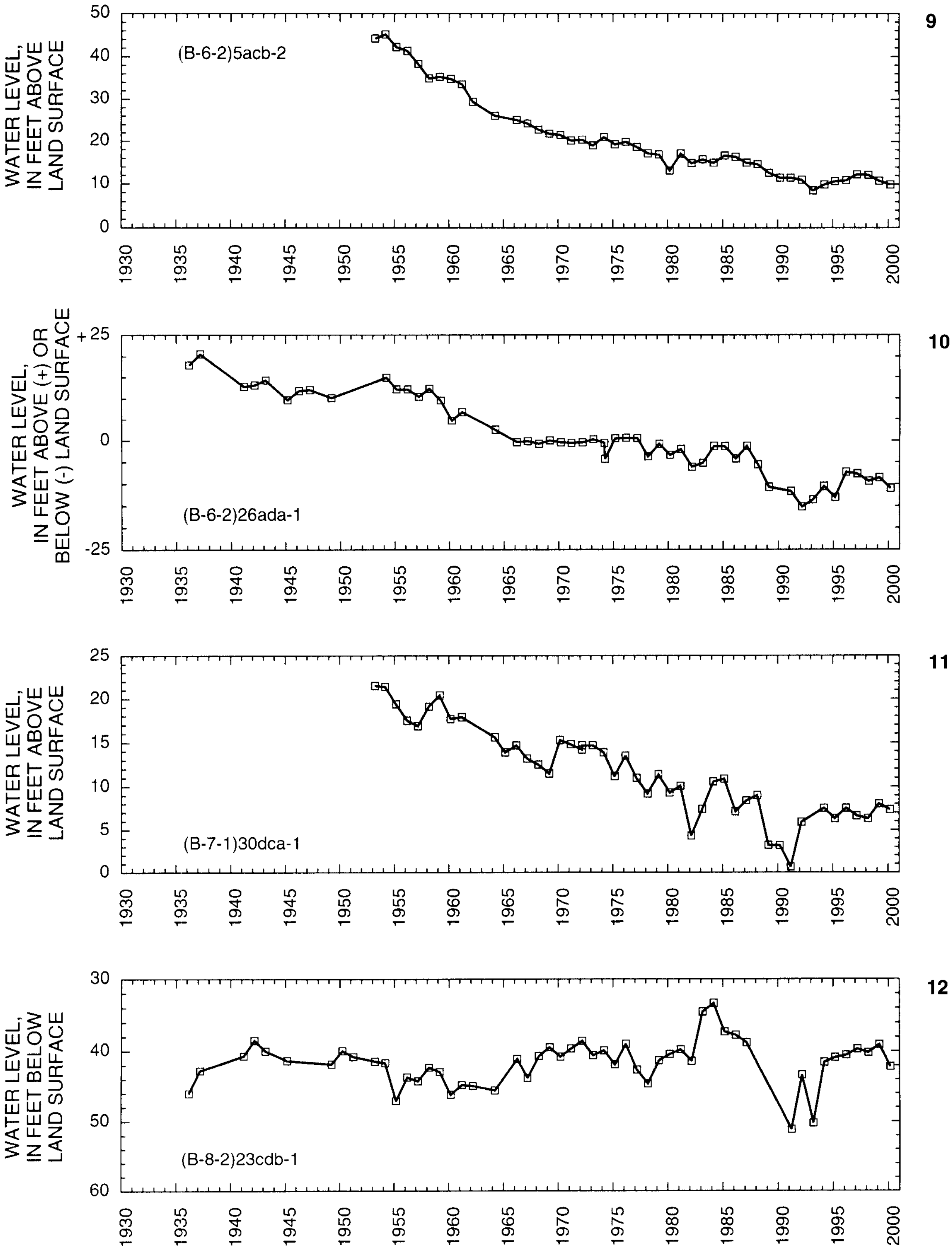


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

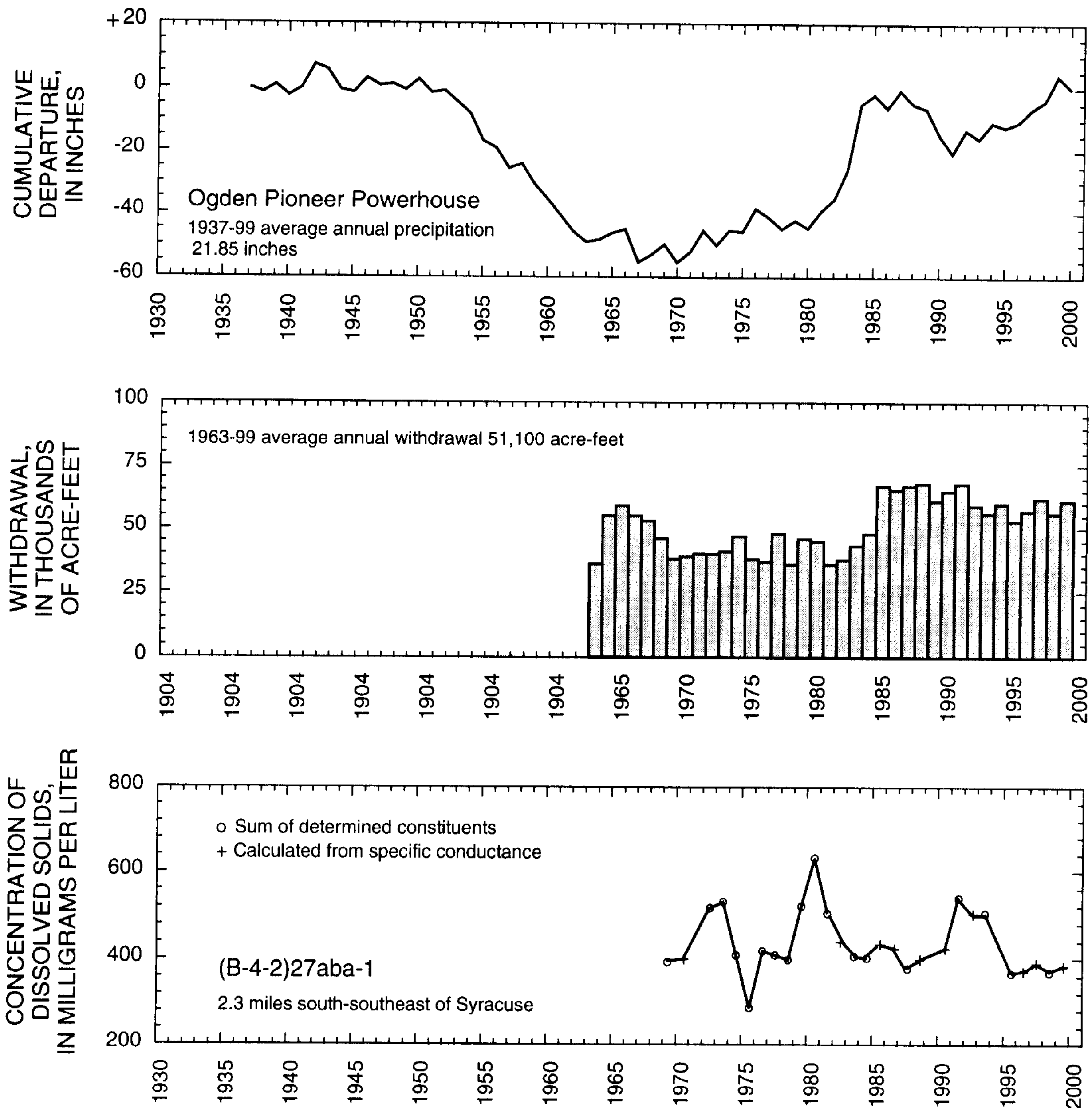


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

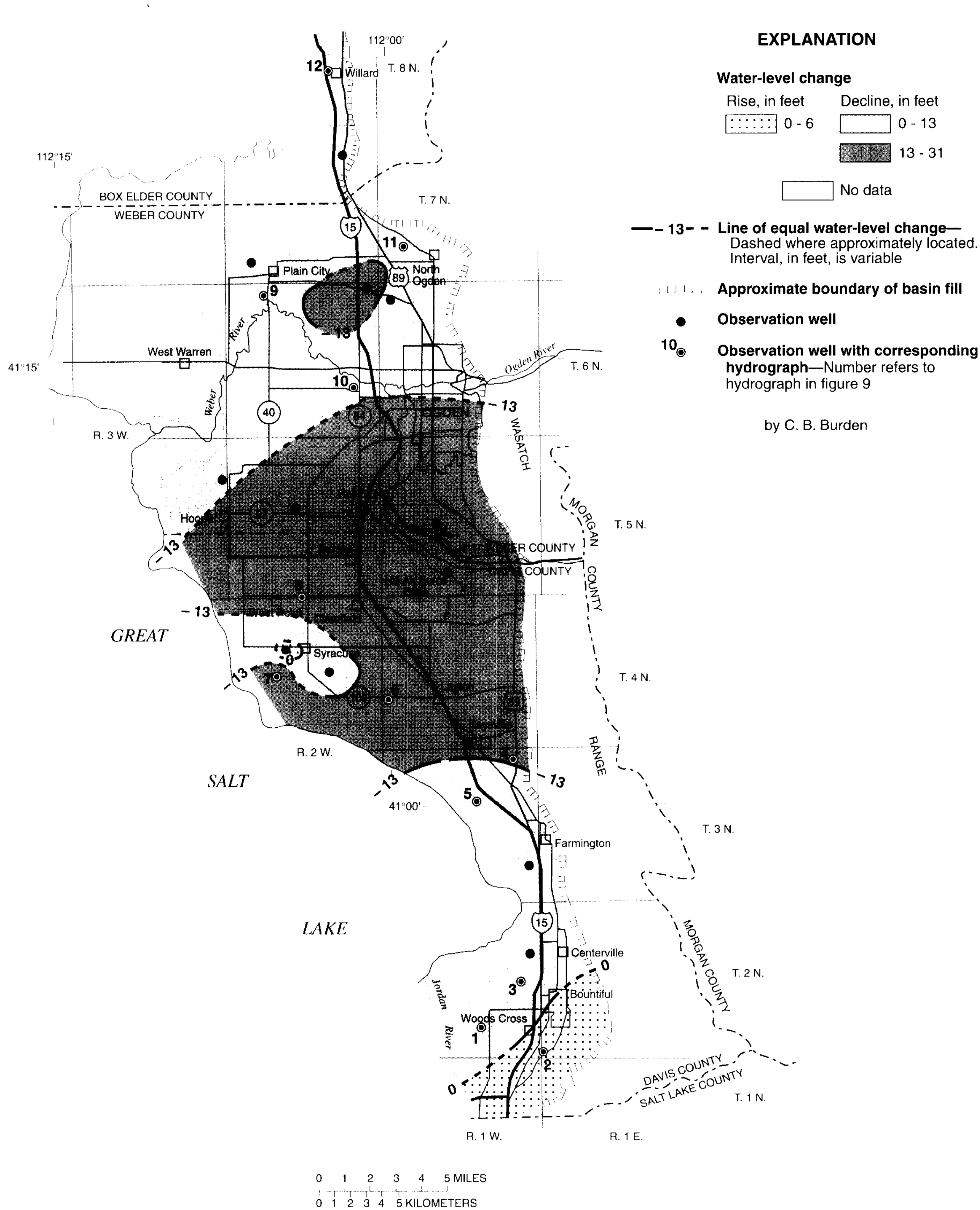


Figure 10. Map of the East Shore area showing change of water level from March 1970 to March 2000.

SALT LAKE VALLEY

By K.K. Johnson

Salt Lake Valley includes about 400 square miles in the lowlands of Salt Lake County. Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions. Recharge to the aquifers is from the mountains that border the valley. In the southern two-thirds of the western half of the valley, ground water moves from the base of the Oquirrh Mountains eastward toward the Jordan River. In the northern one-third of the western half of the valley, the direction of movement is mostly toward Great Salt Lake. In the eastern half of the valley, ground water moves westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface water and ground water from the valley.

Total estimated withdrawal of water from wells in Salt Lake Valley in 1999 was about 126,000 acre-feet, which is 4,000 acre-feet more than in 1998 and about 7,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3). Withdrawal for public supply was about 72,700 acre-feet, which is 5,200 acre-feet less than was reported in 1998. Withdrawal for industrial use was about 24,600 acre-feet, which is 5,100 acre-feet more than was reported for 1998.

The location of wells in Salt Lake Valley in which the water level was measured during February 2000 is shown in figure 11. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at the Salt Lake City Weather Service Office (WSO) (International Airport) are shown in figure 12. Precipitation at the Salt Lake City WSO during 1999 was 12.89 inches, 2.31 inches less than the average annual precipitation for 1931-99.

The relation of the water level in selected wells completed in the principal aquifer to cumulative departure from average annual precipitation at Silver Lake near Brighton, and the relation of the water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well are shown in figure 13. Precipitation at Silver Lake near Brighton was 39.90 inches in 1999, which is 2.93 inches less than the average annual precipitation for 1931-99 and 9.91 inches less than in 1998. The water level in 9 of 12 selected observation wells in the principal aquifer of the Salt Lake Valley was lower in February 2000 than it was in February 1999, and the water level in 3 wells was higher. The water level in most of the observation wells was highest during 1985-87, which corresponds to a period of much-greater-than-average precipitation during 1982-86. The water level in most of the observation wells was lowest during 1990-93, which corresponds to a drier period during 1987-92.

Water levels in observation wells in the southeastern part of the valley show long-term effects from large withdrawals. The water level in well (C-2-1)24adc-1 has declined about 24 feet since 1940, although in February 2000 it was 4.4 feet above its all-time low in 1992.

The chloride concentration from well (D-1-1) 7abd-6 (located in Artesian Well Park in Salt Lake City) was 150 milligrams per liter in July 1999; this is the highest measured concentration for this well on record. The chloride concentration has continued to increase since the 1960s.

Water levels in the principal aquifer generally declined in most of the Salt Lake Valley from February 1970 to February 2000 (fig. 14). The areas of greatest decline were to the south and west of Riverton, and east of Midvale and south of Holladay. The largest decline, 38.9 feet, was noted in a well southwest of Riverton. Declines in water levels were probably the result of increased withdrawals due to increased population and urbanization throughout the 1980s and 1990s. Rises in water levels occurred in the northeastern and northwestern parts of the Salt Lake Valley. The largest rise, 9.4 feet, was noted in a well near Memory Grove, north of downtown Salt Lake City.

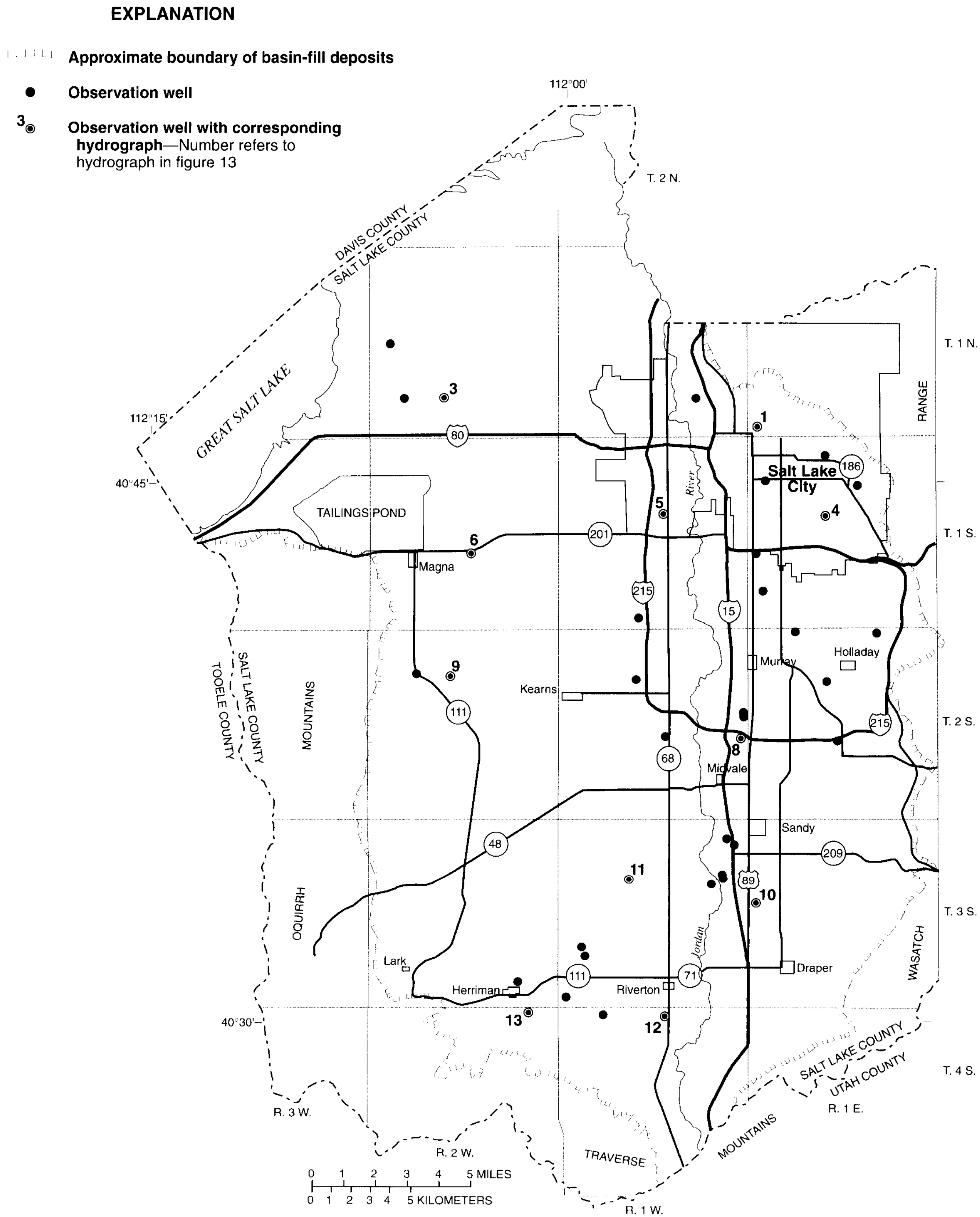


Figure 11. Location of wells in Salt Lake Valley in which the water level was measured during February 2000.

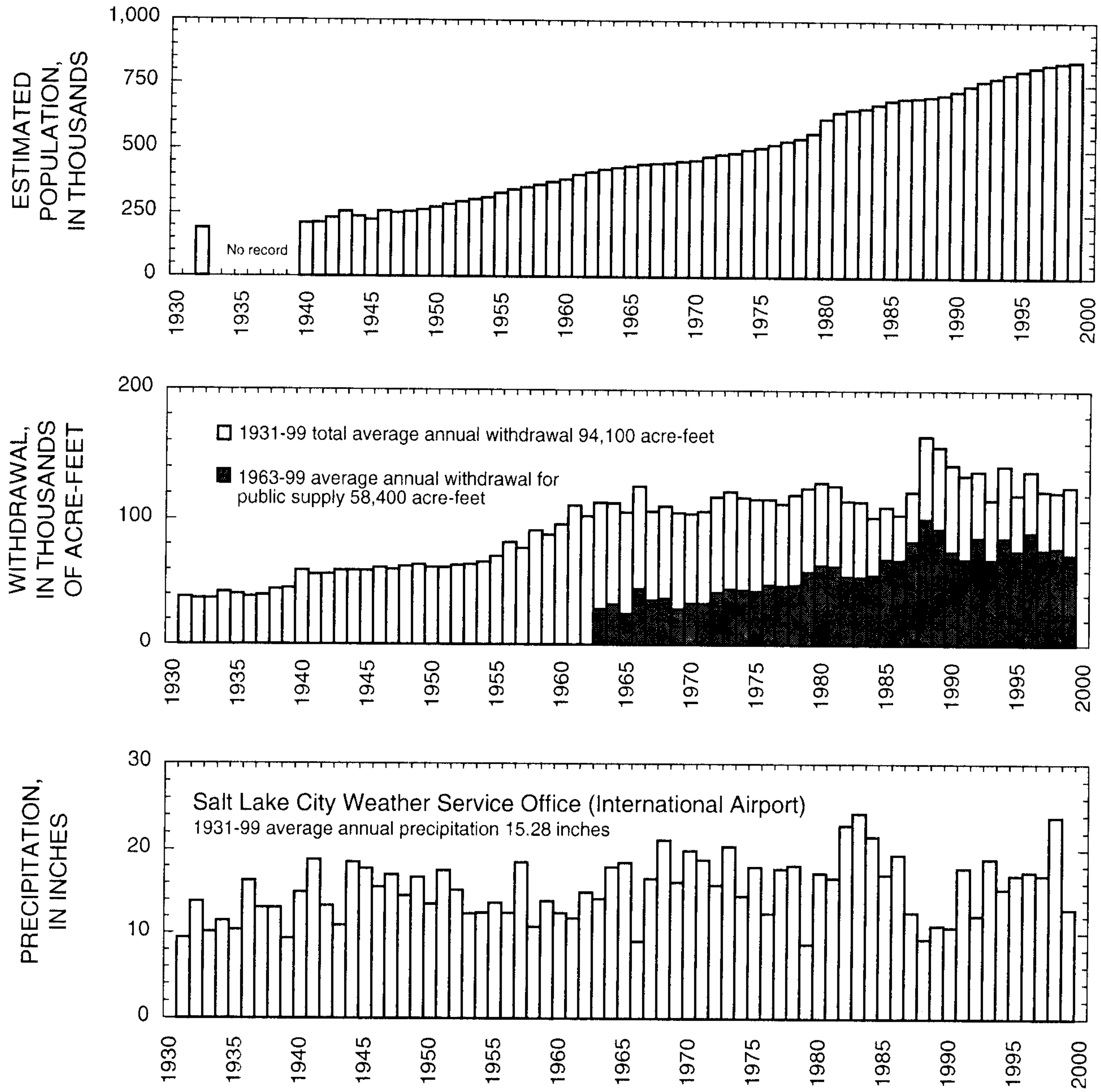


Figure 12. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (International Airport).

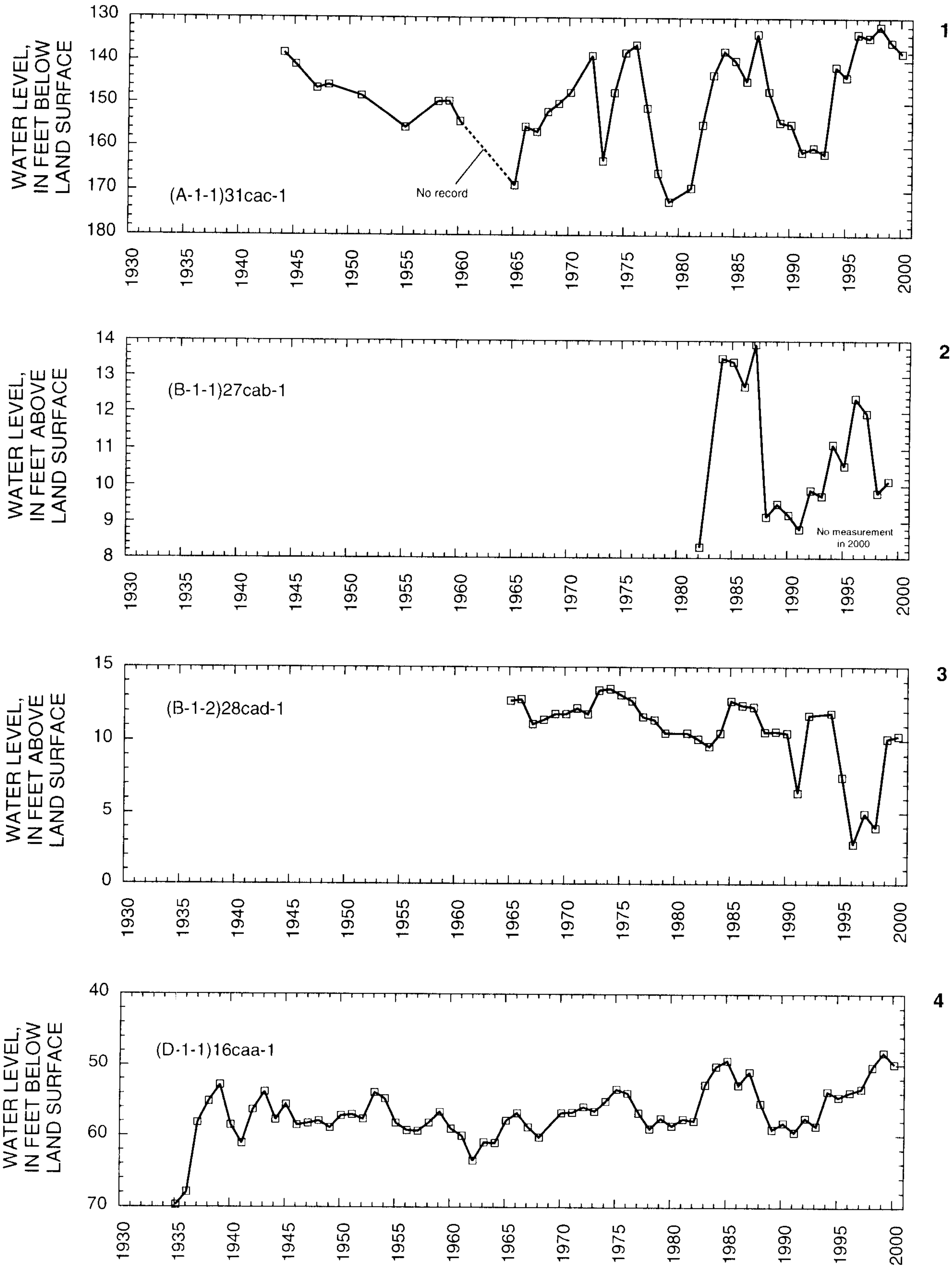


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.

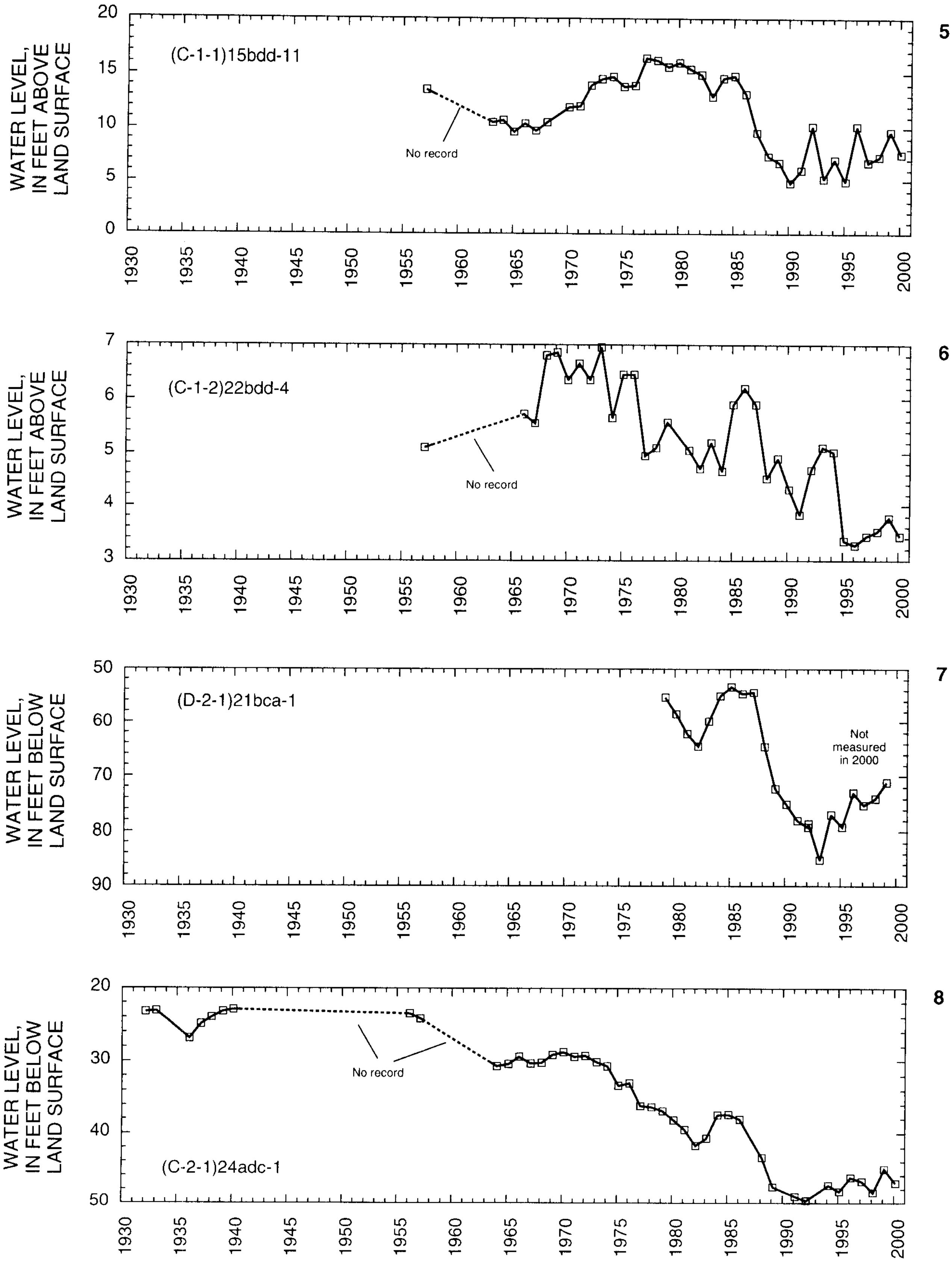


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

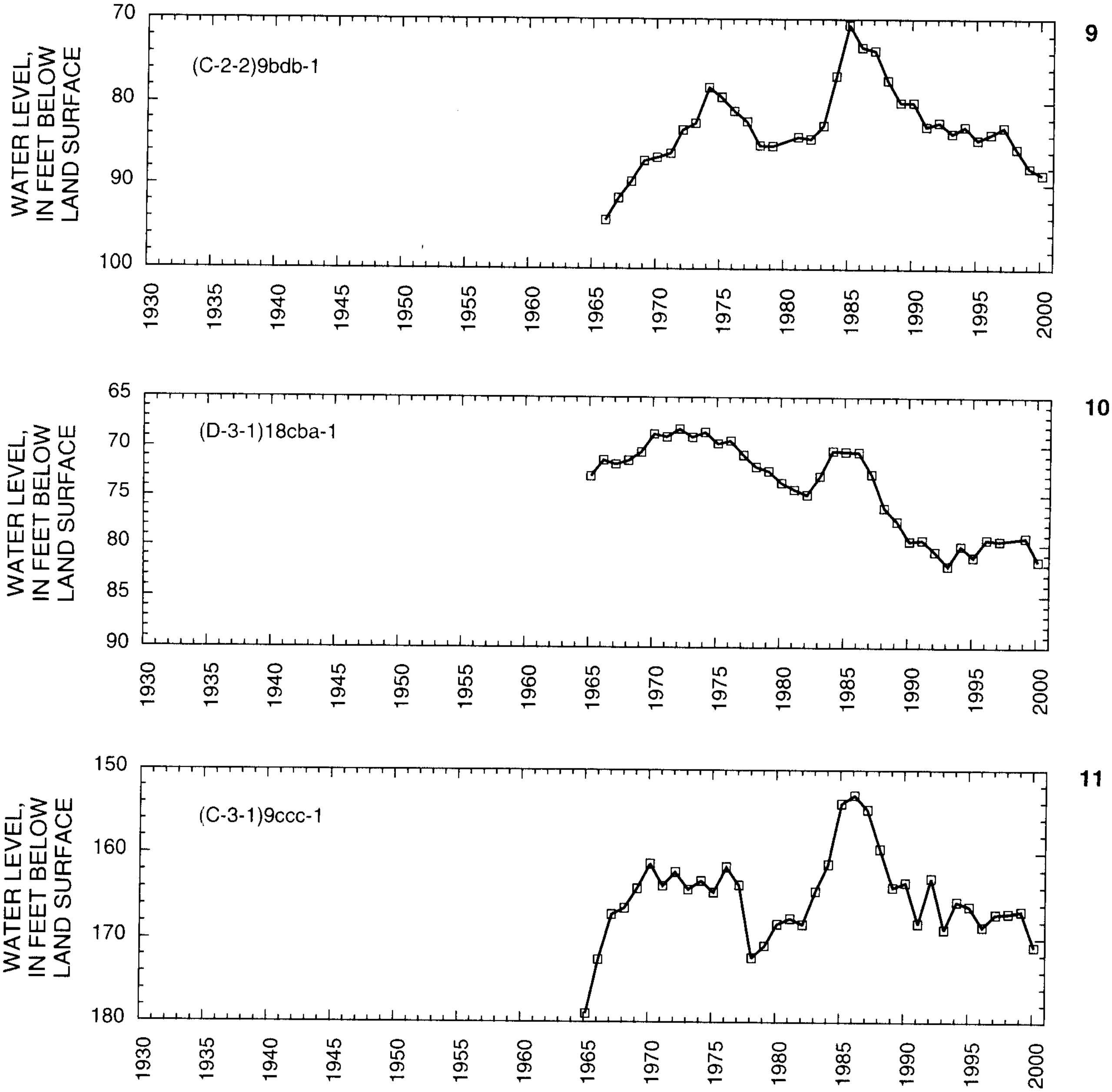
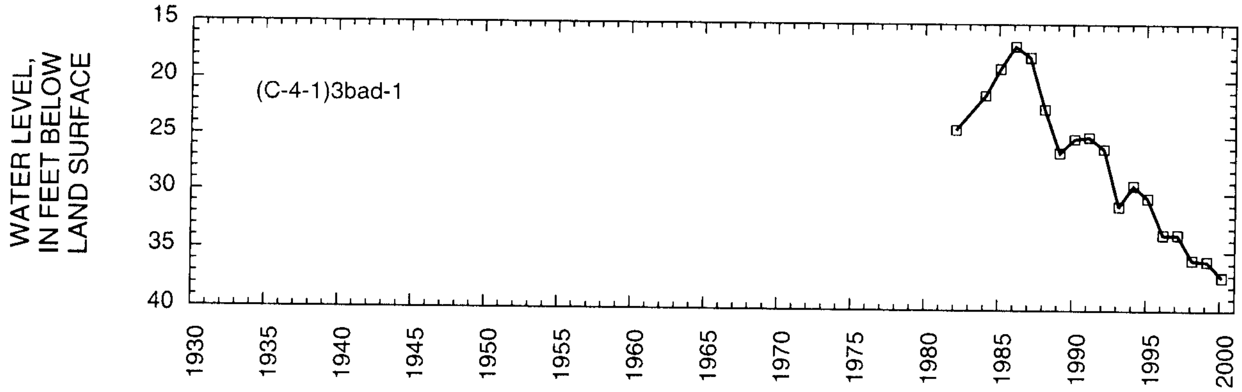


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.



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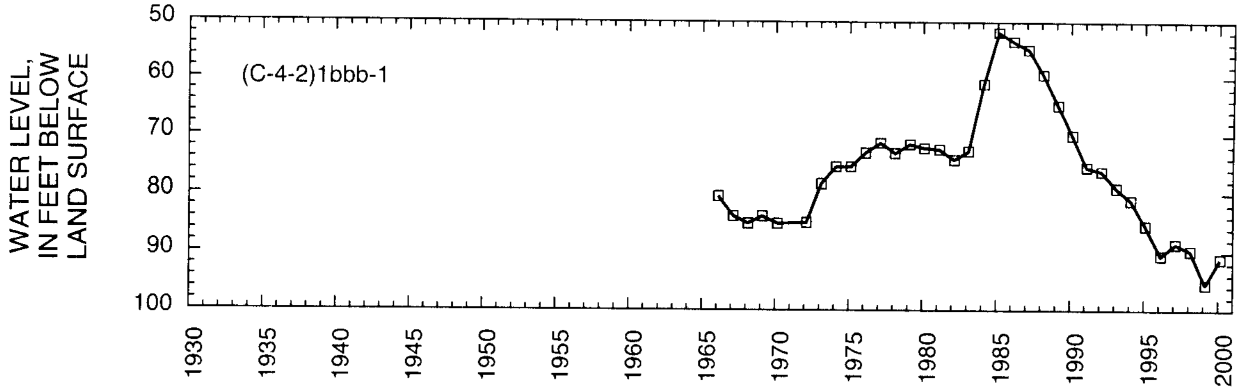

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Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

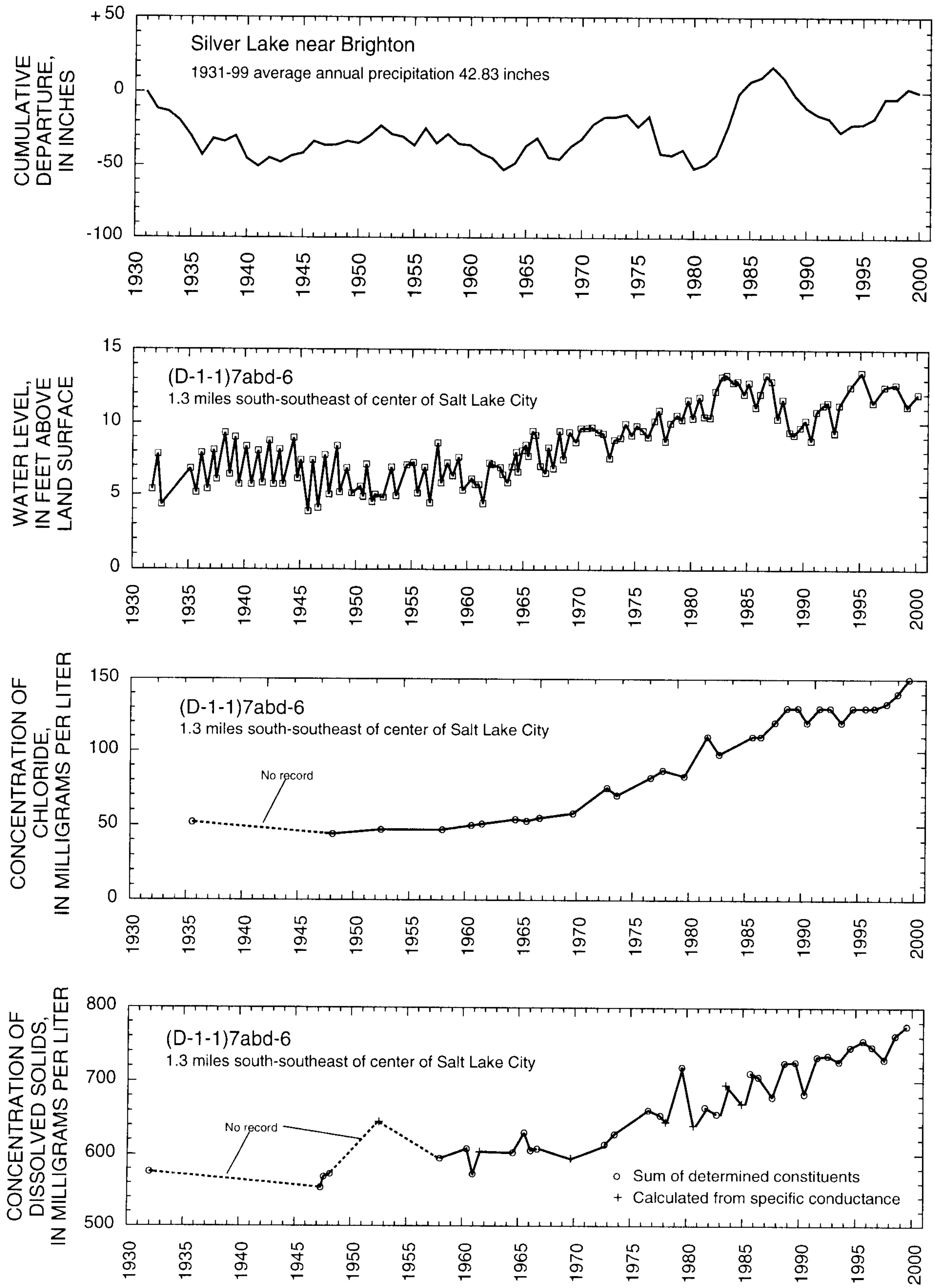


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

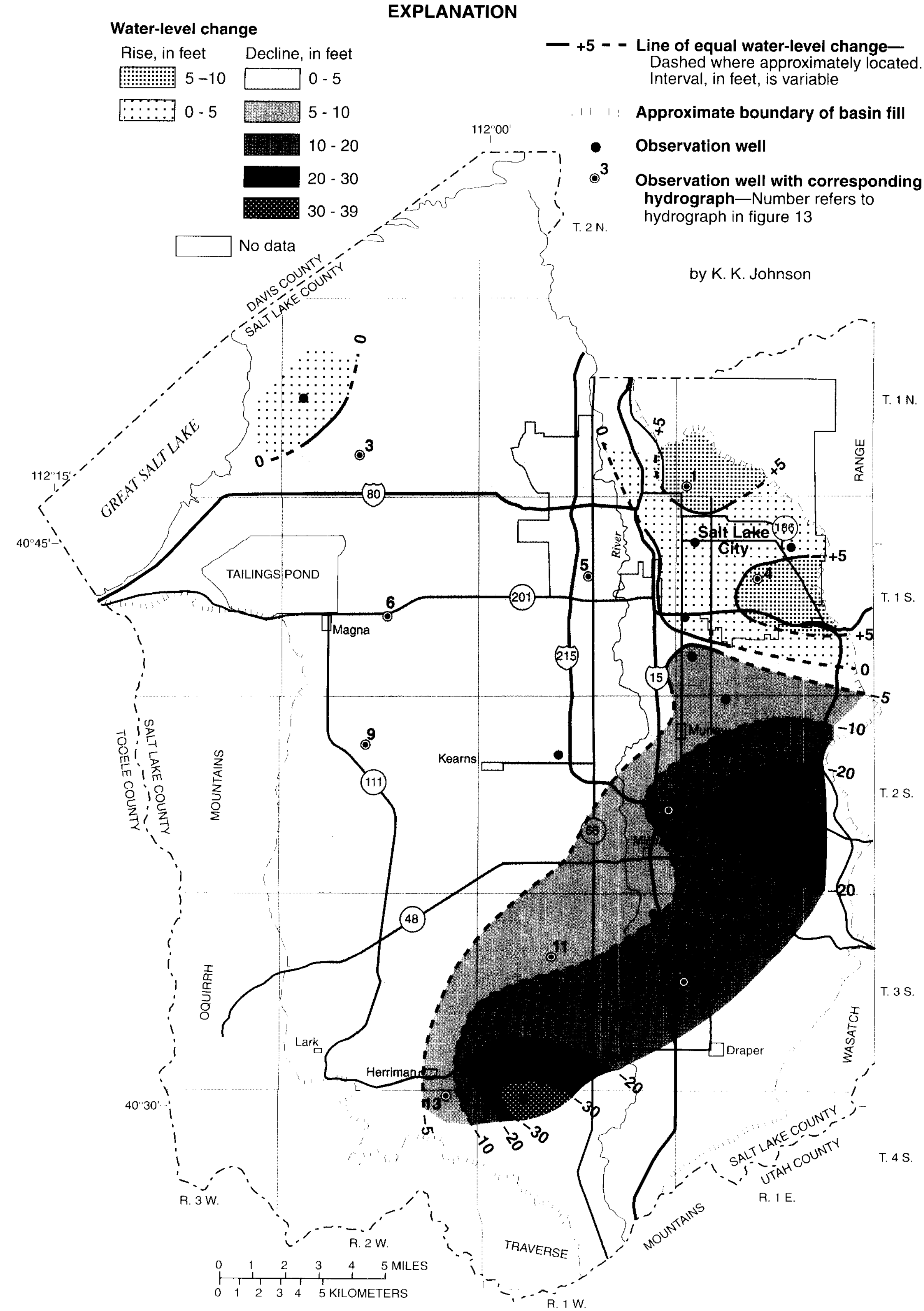


Figure 14. Map of Salt Lake Valley showing change of water level from February 1970 to February 2000.

TOOELE VALLEY

By T.A. Kenney

Tooele Valley is between the Stansbury Mountains and Oquirrh Mountains and extends from Great Salt Lake to a low ridge called South Mountain. The total area of the valley is about 250 square miles.

Ground water occurs in the unconsolidated deposits in Tooele Valley under both water-table and artesian conditions, but nearly all the water withdrawn by wells is from artesian aquifers.

Total estimated withdrawal of water from wells in Tooele Valley in 1999 was about 21,000 acre-feet, which is 2,000 acre-feet more than the revised withdrawal for 1998 and 6,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3). The increase in withdrawals is the result of less-than-average precipitation during 1999. Withdrawal for public supply was about 4,000 acre-feet, which is 1,400 acre-feet more than the revised withdrawal for 1998. Withdrawal for irrigation use in 1999 was about 15,700 acre-feet, which is 700 acre-feet more than what was reported for 1998.

The location of wells in Tooele Valley in which the water level was measured during March 2000 is shown in figure 15. The relation of the water level in selected wells to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells is shown in figure 16. Precipitation during 1999 at Tooele was 16.02 inches, 10.67 inches less than in 1998 and 1.83 inches less than the average annual precipitation for 1936-99.

The water level in the selected observation wells (fig. 15) in the principal aquifer of Tooele Valley generally was higher in the northern part and lower in the southern part from March 1999 to March 2000. Water levels generally rose during the last 5 years as a result of greater-than-average precipitation.

Water levels generally rose from March 1970 to March 2000 in Tooele Valley (fig. 17). The greatest rises occurred in the central part of the valley. The largest rise, 18.2 feet, occurred in a well west of Erda. The rises may be related to generally greater-than-average precipitation during this period. Small declines in water levels of less than 3 feet occurred in the northern and northwestern parts of the valley.

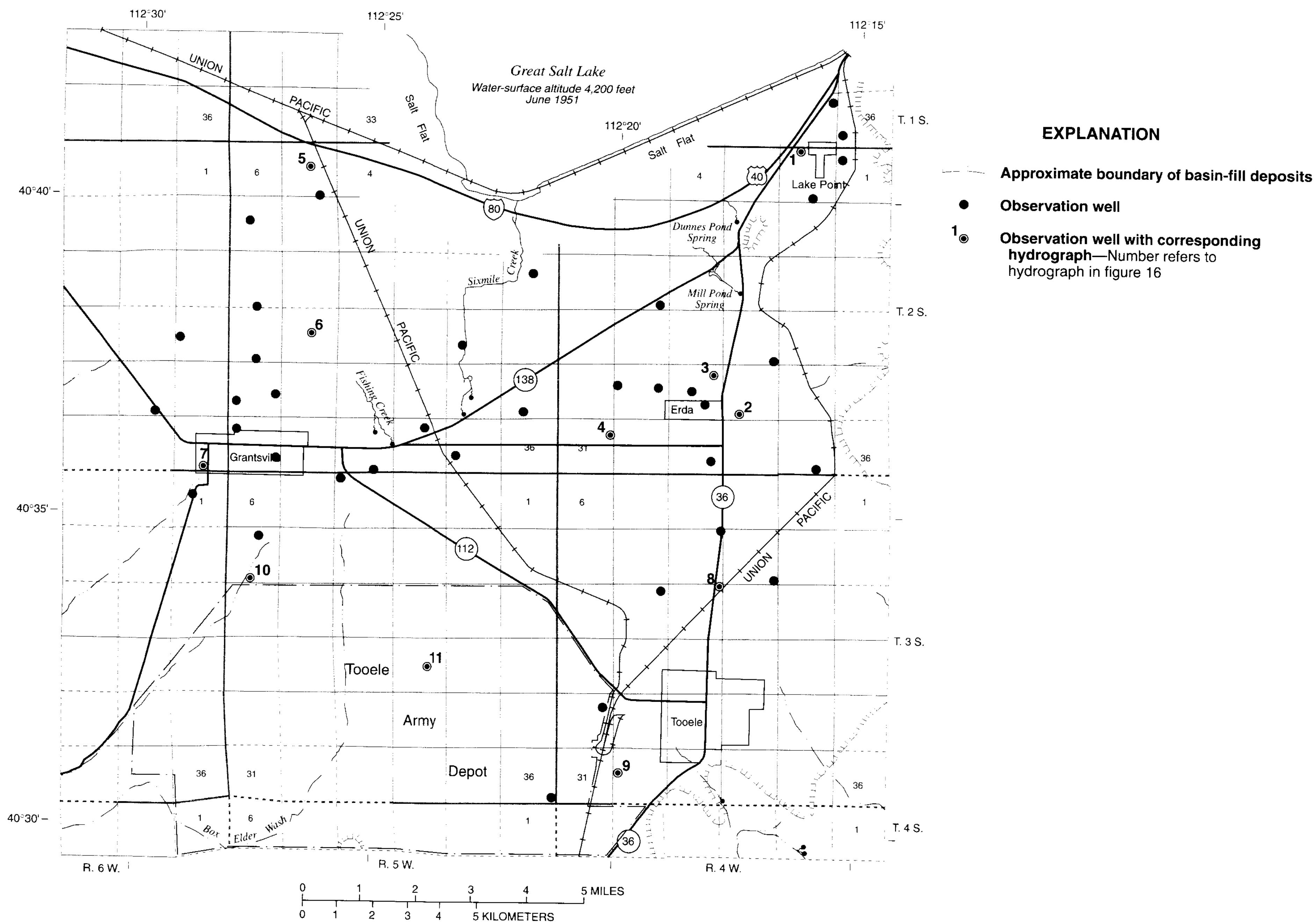


Figure 15. Location of wells in Tooele Valley in which the water level was measured during March 2000.

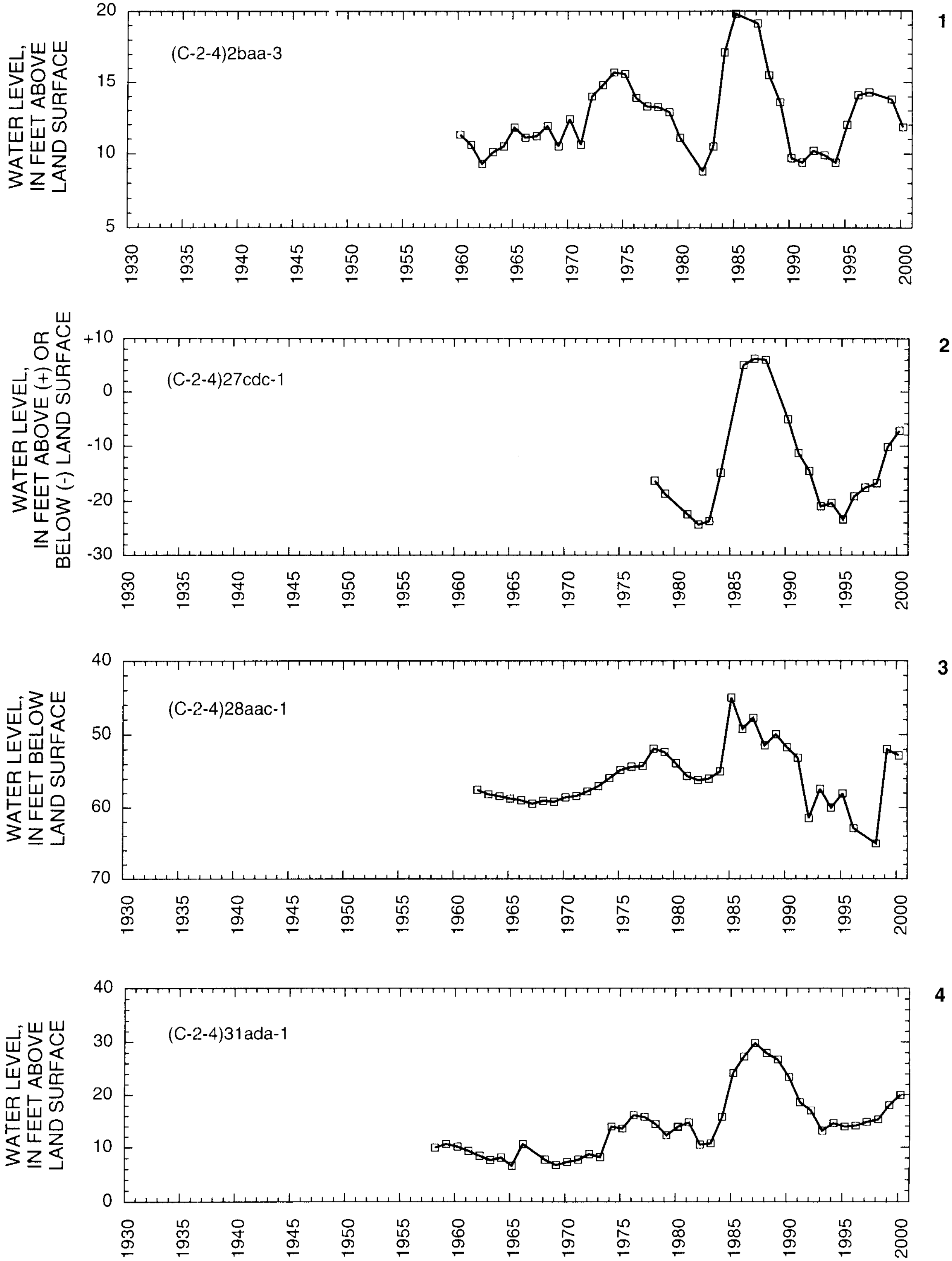


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells.

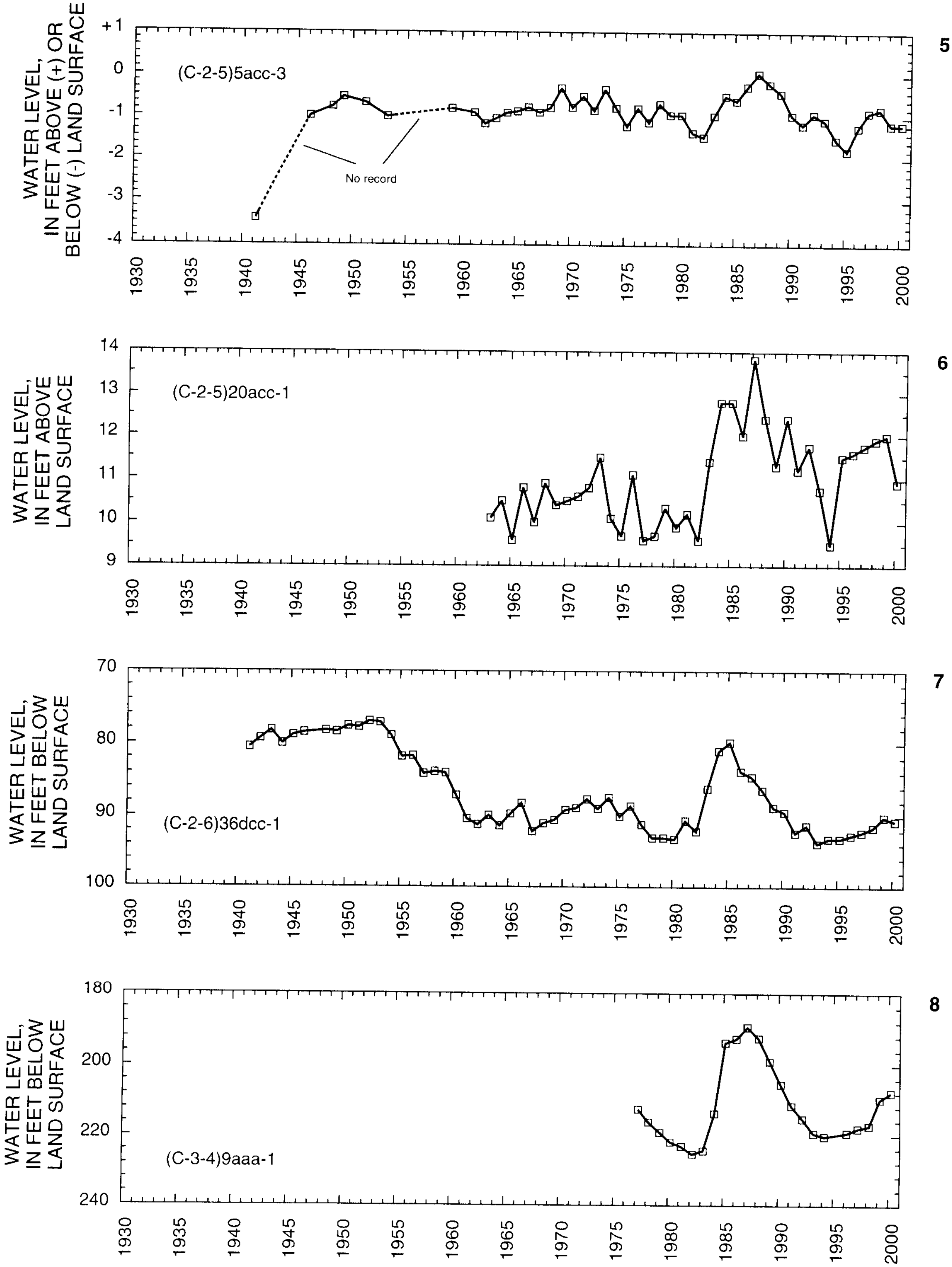
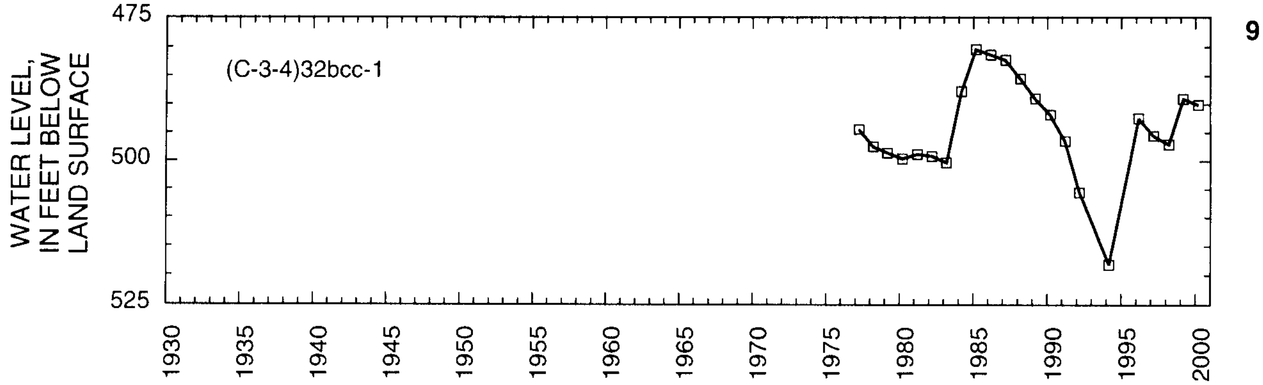
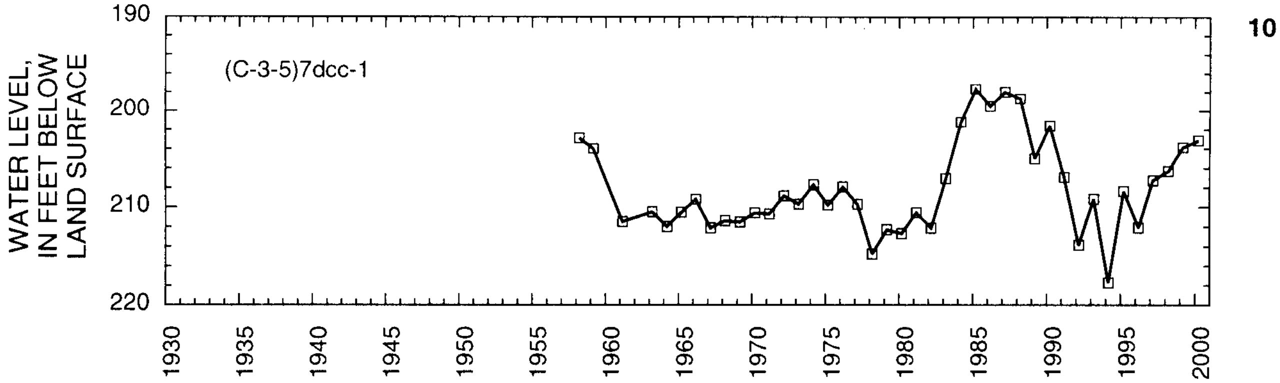


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.





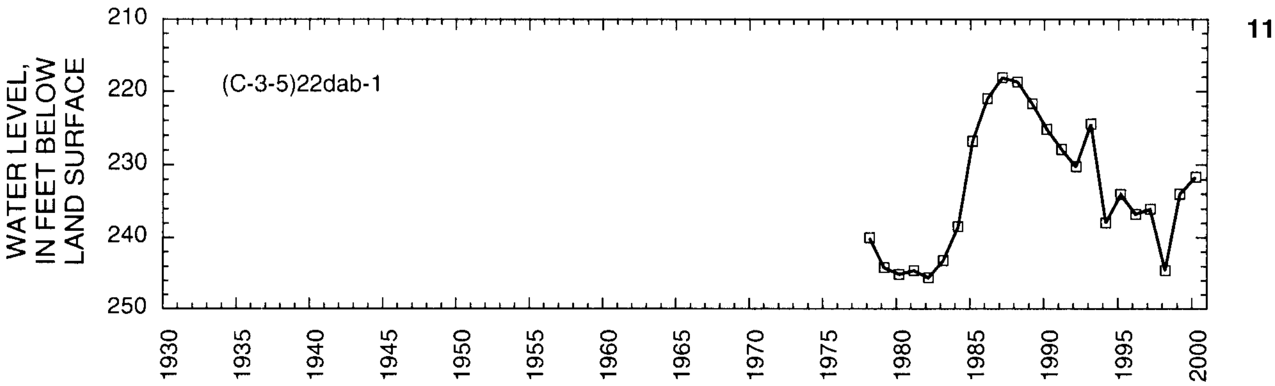
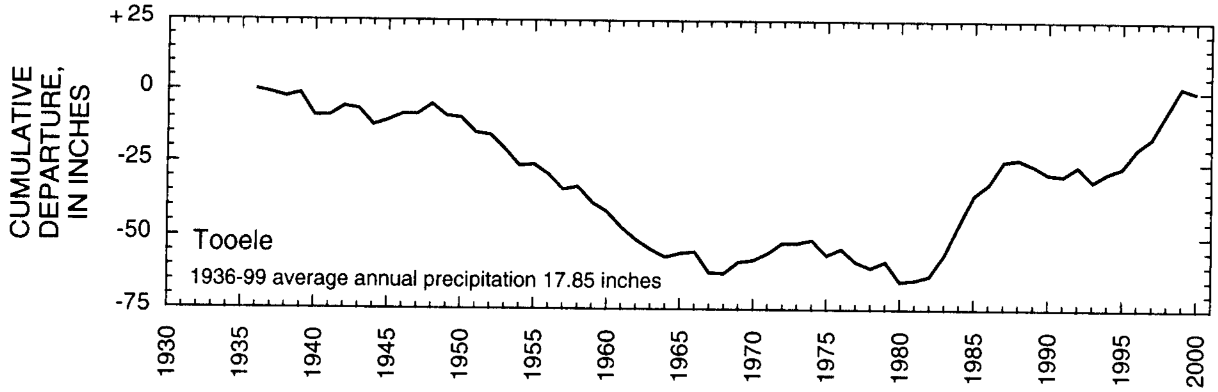


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.



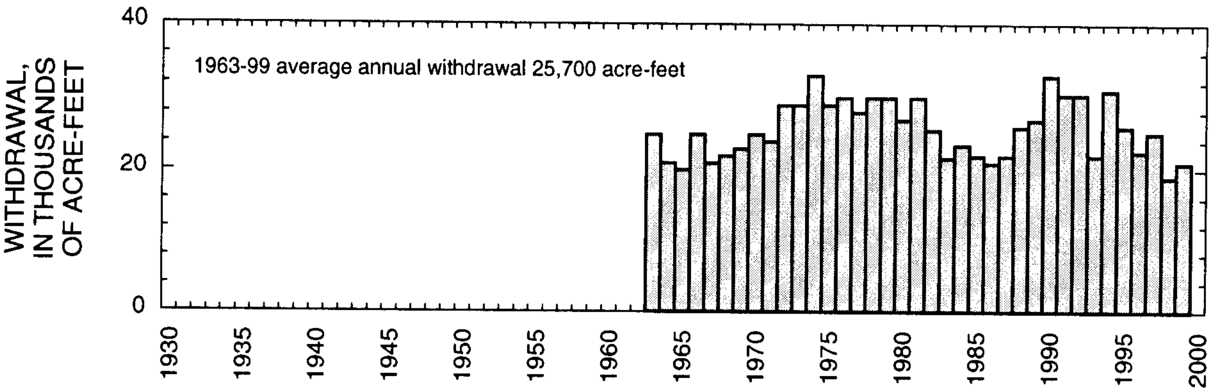


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.

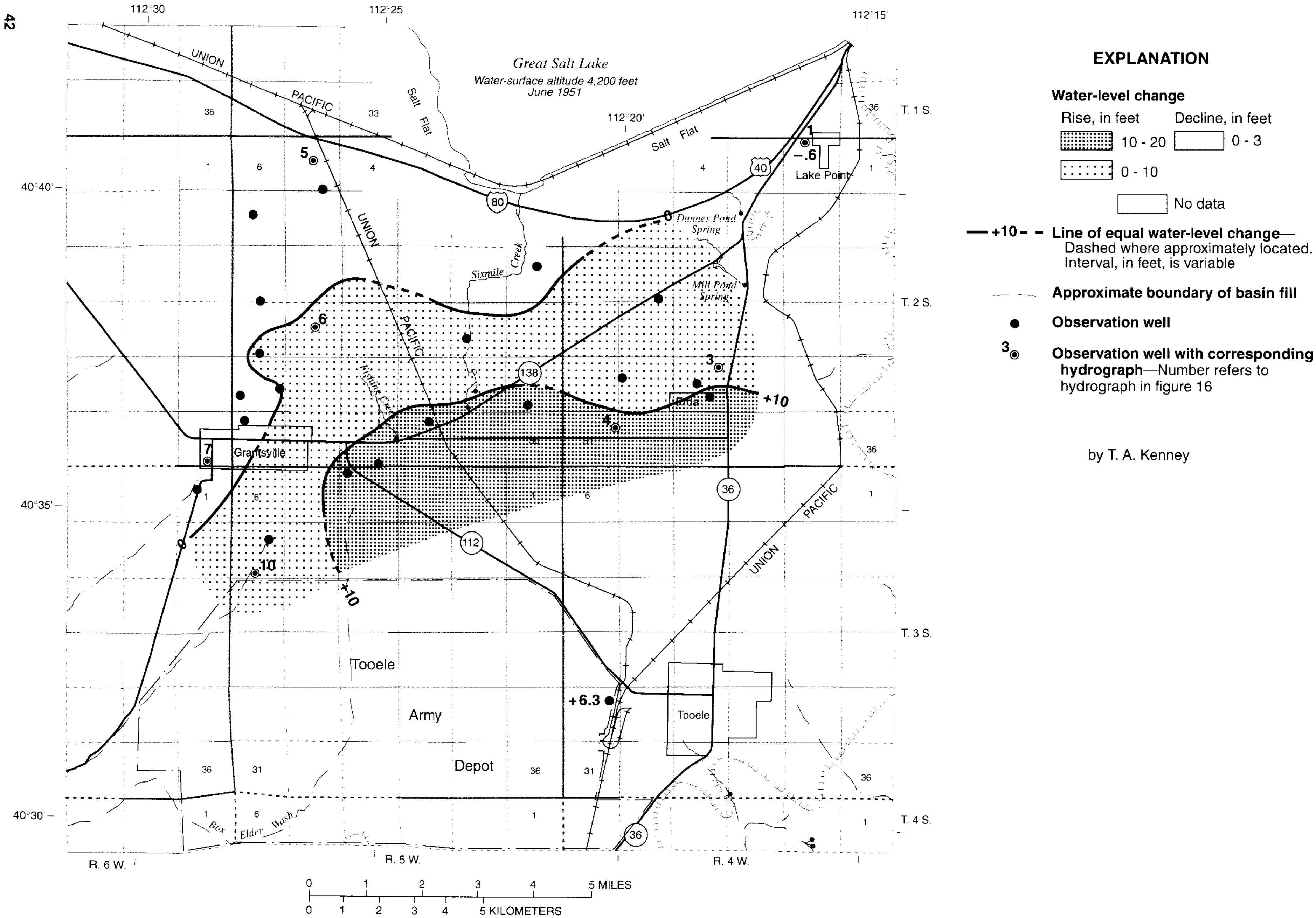


Figure 17. Map of Tooele Valley showing change of water level from March 1970 to March 2000.

UTAH AND GOSHEN VALLEYS

By S.J. Brockner

Northern Utah Valley is the part of Utah Valley that is north of Provo Bay. Ground water occurs in unconsolidated basin-fill deposits in the valley. The principal ground-water recharge area for the basin fill is in the eastern part of the valley, along the base of the Wasatch Range.

Southern Utah Valley is the part of Utah Valley south of Provo and bounded by the Wasatch Range, West Mountain, and the northern extension of Long Ridge. Goshen Valley is south of the latitude of Provo and is bounded by West Mountain, Long Ridge, and the East Tintic Mountains. Ground water occurs in the basin fill under both water-table and artesian conditions, but most wells discharge from artesian aquifers.

Total estimated withdrawal of water from wells in Utah and Goshen Valleys in 1999 was about 115,000 acre-feet, which is 29,000 acre-feet more than what was reported for 1998, and 7,000 acre-feet more than the average annual withdrawal for 1989-98 (tables 2 and 3). Withdrawal in northern Utah Valley was about 62,500 acre-feet, which is 13,600 acre-feet more than in 1998; withdrawal in southern Utah Valley was about 34,600 acre-feet, which is 12,100 acre-feet more than in 1998; withdrawal in Goshen Valley was about 17,700 acre-feet, which is 3,200 acre-feet more than in 1998. Most of the total increase in withdrawal probably resulted from increased withdrawal for public supply and irrigation.

The location of wells in Utah and Goshen Valleys in which the water level was measured during March 2000 is shown in figure 18. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of the Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells is shown in figure 19.

Water levels in Goshen Valley and in the northern and southern parts of Utah Valley generally rose in the early 1980s. The rise corresponds to a period of greater-than-average precipitation and recharge from surface water. Water levels generally declined from 1985 to 1993 in Utah Valley and generally rose from 1993 to 1999. This rise resulted from greater-than-average precipitation during this period. Water levels generally declined from March 1999 to March 2000. Water levels in Goshen Valley generally have declined since 1992.

Discharge of the Spanish Fork River at Castilla in 1999 was 186,600 acre-feet, which is 18,000 acre-feet more than the 1933-99 annual average. Precipitation at Silver Lake near Brighton in 1999 was 39.90 inches, which is 2.93 inches less than the 1931-99 annual average and 9.91 inches less than in 1998. Precipitation at Spanish Fork Powerhouse in 1999 was 18.74 inches, which is 0.88 inch less than the 1937-99 annual average and 8.09 inches less than in 1998.

Water levels from March 1970 to March 2000 generally declined in northern Utah Valley, part of southern Utah Valley, and the northern part of Goshen Valley (fig. 20). The declines probably were the result of increased withdrawals for public supply and irrigation use. Rises in water levels in southern Goshen Valley and parts of southern Utah Valley probably were the result of generally greater-than-average precipitation for the period.

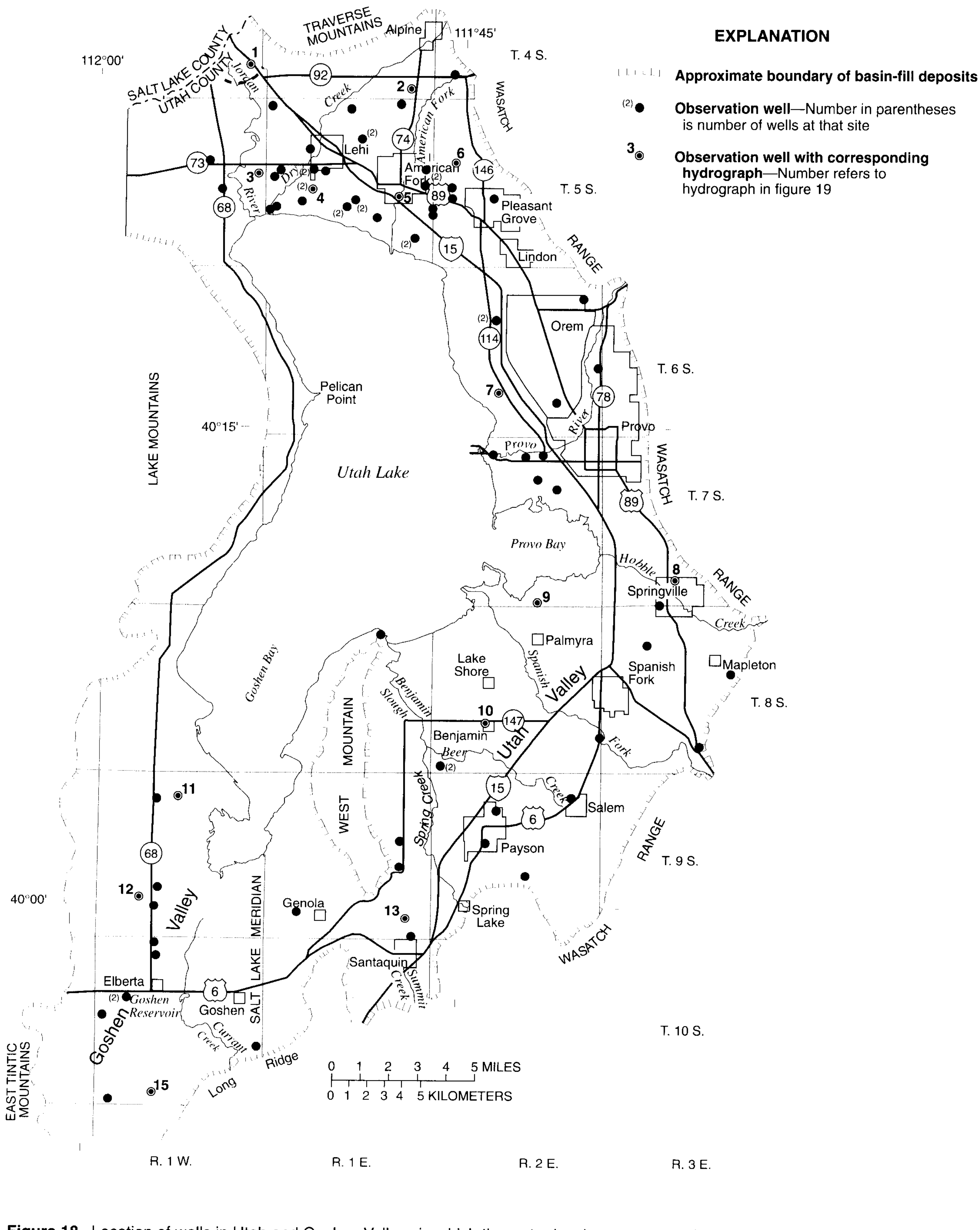


Figure 18. Location of wells in Utah and Goshen Valleys in which the water level was measured during March 2000.

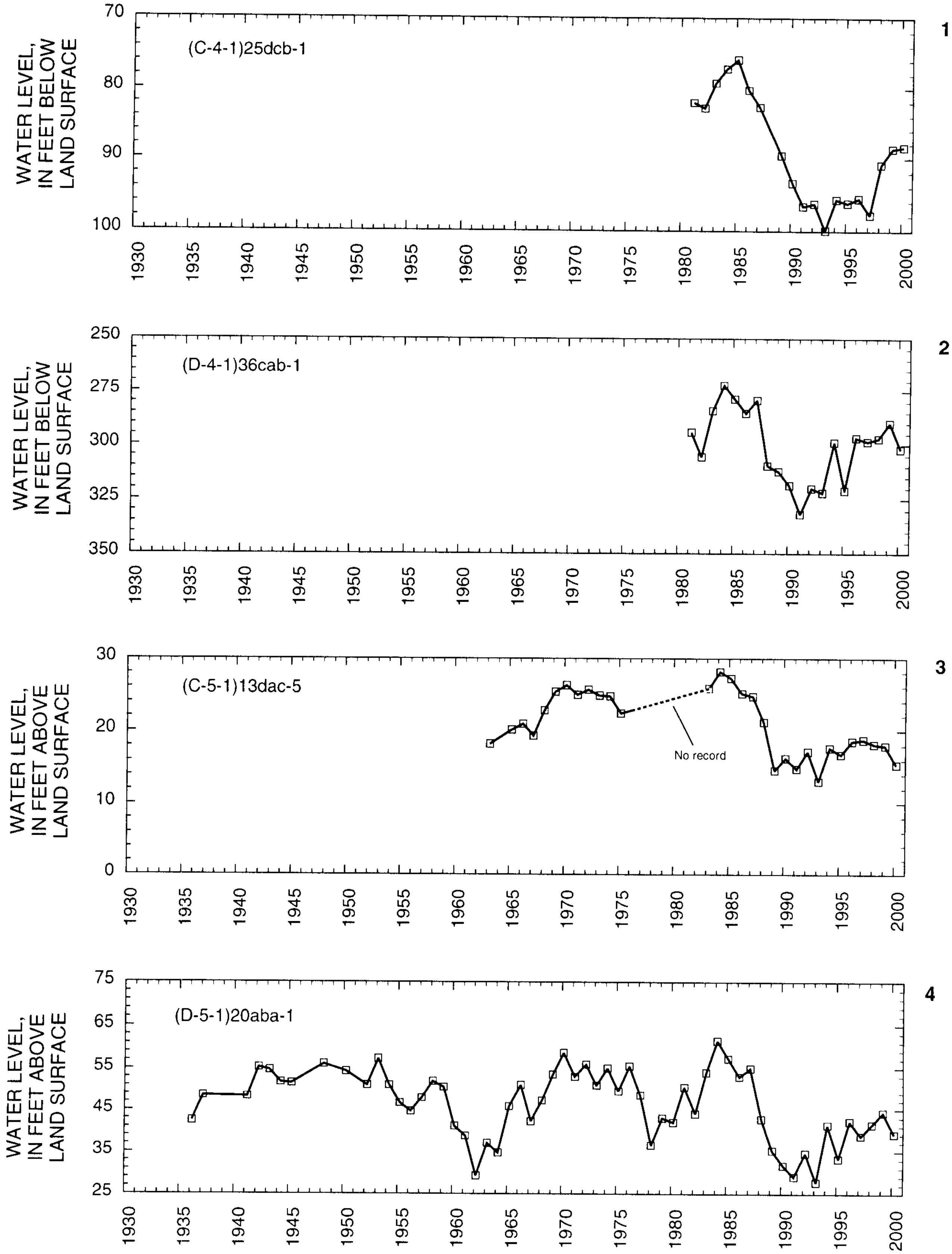


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells.

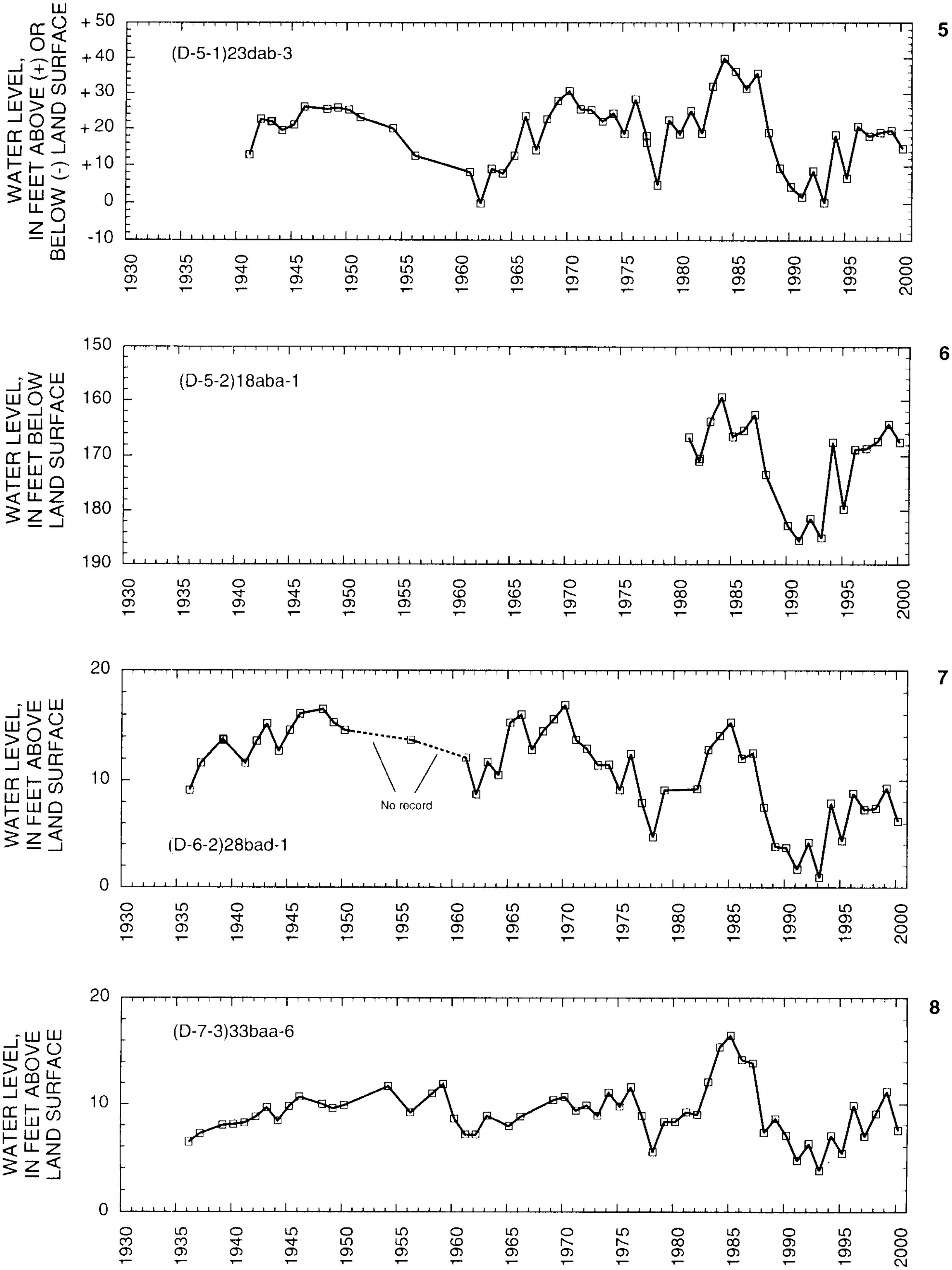


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

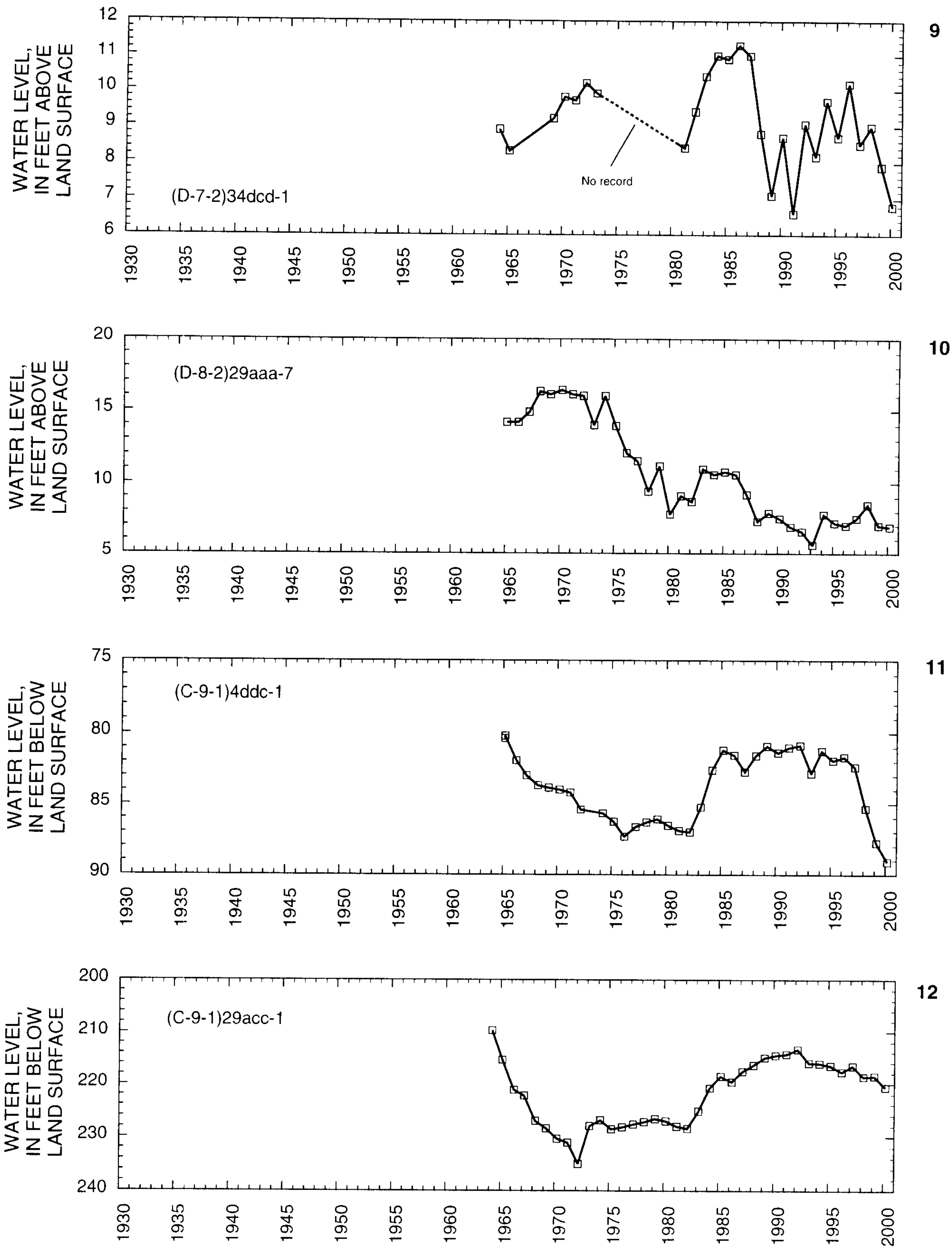
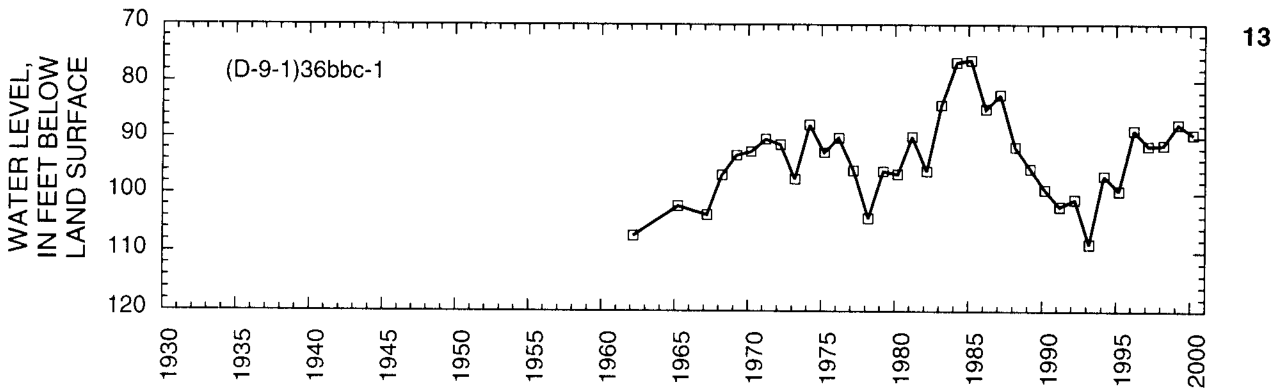
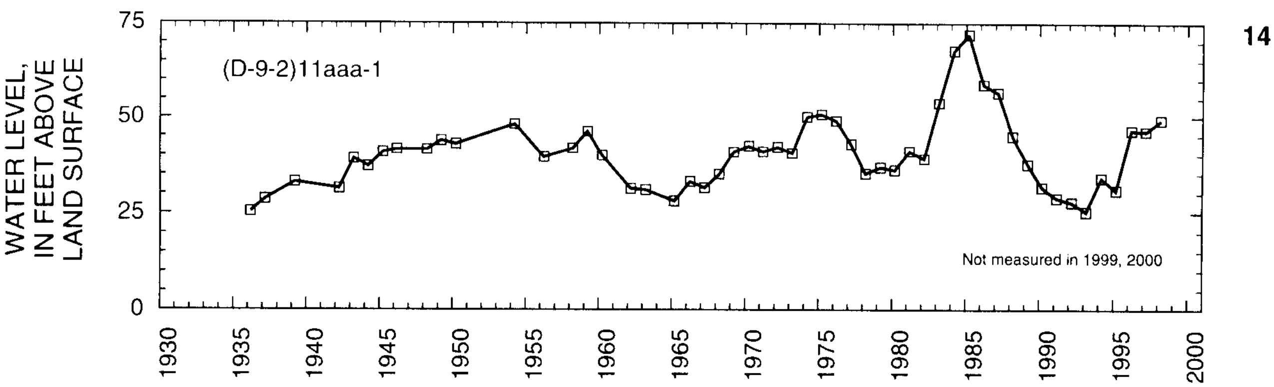


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells—Continued.





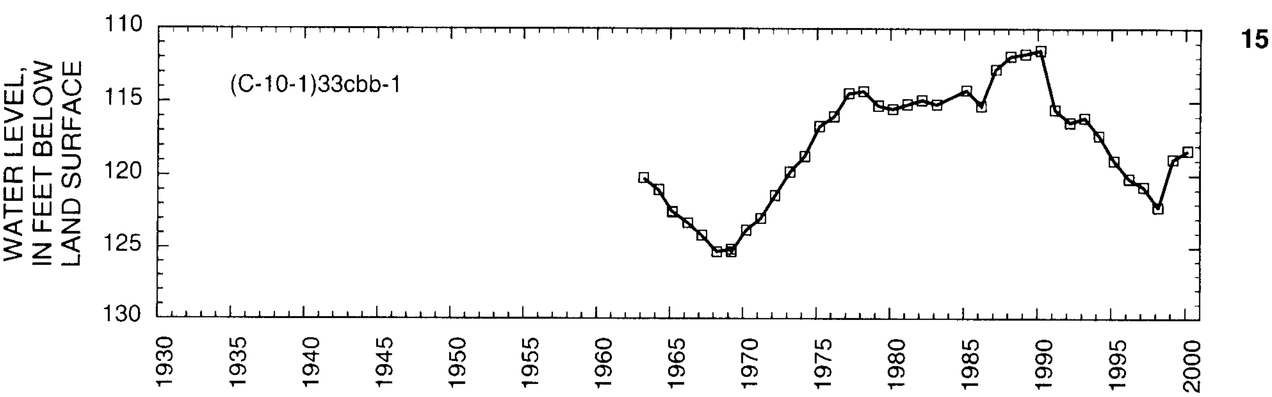


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

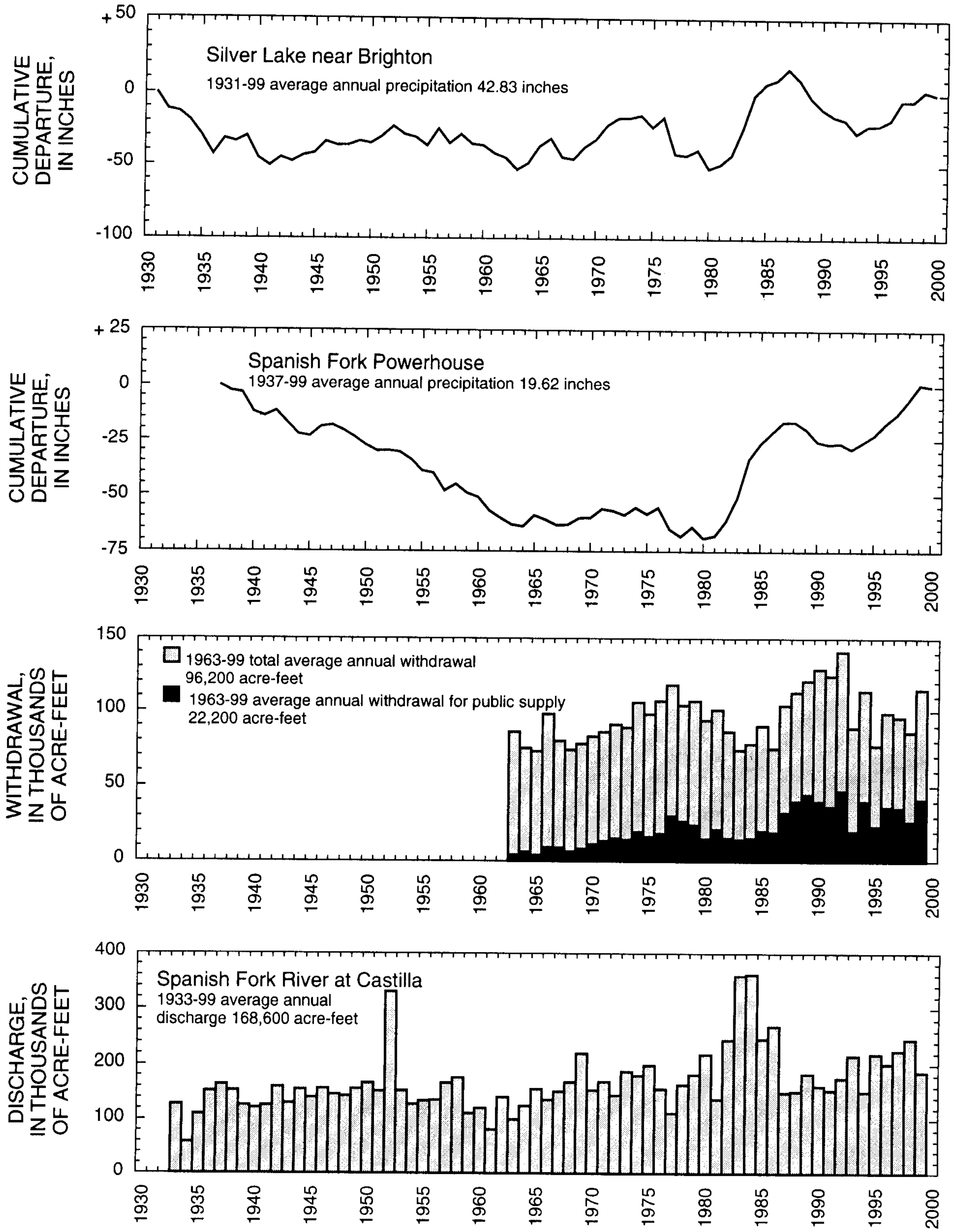


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

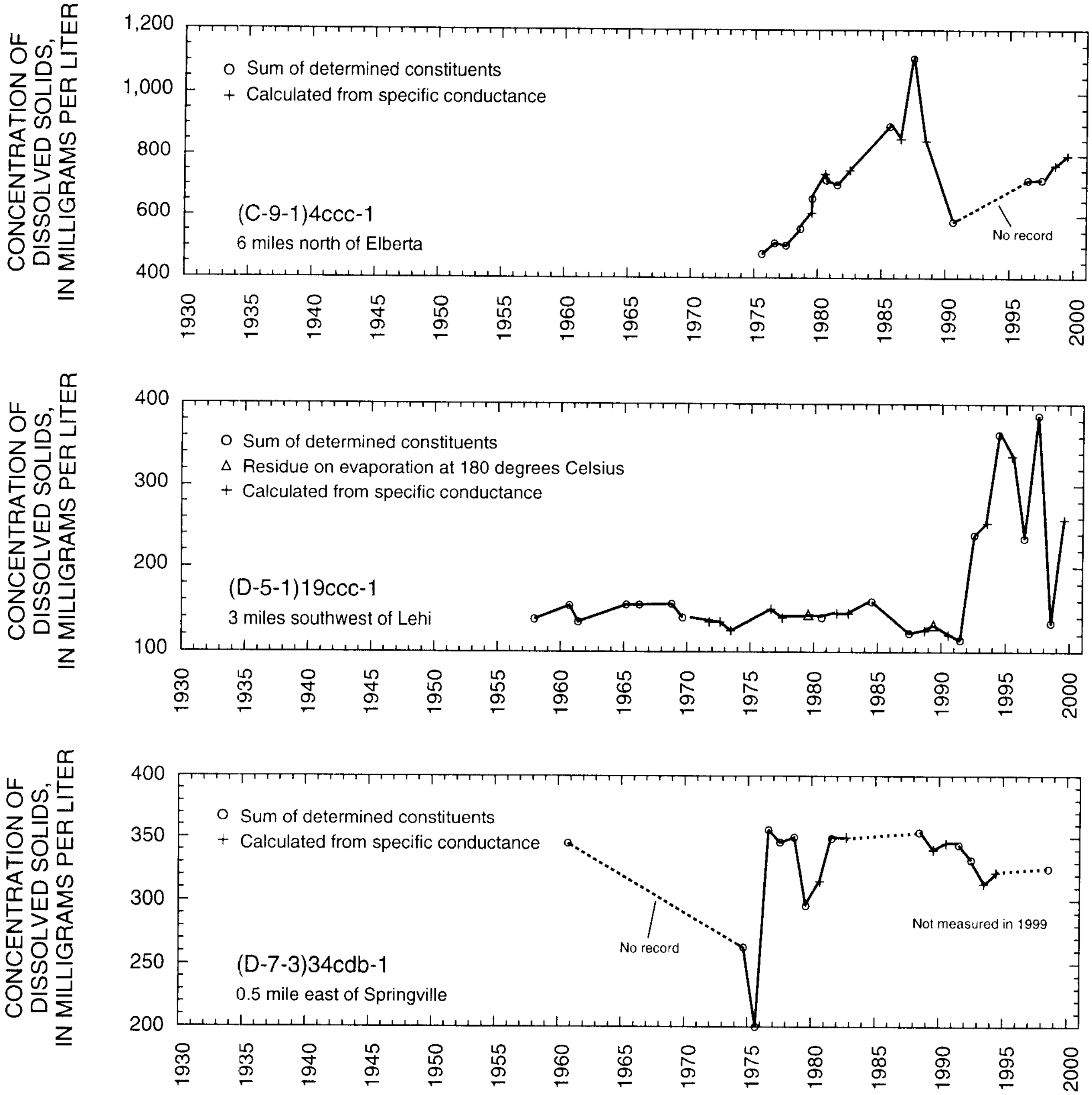


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork River at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

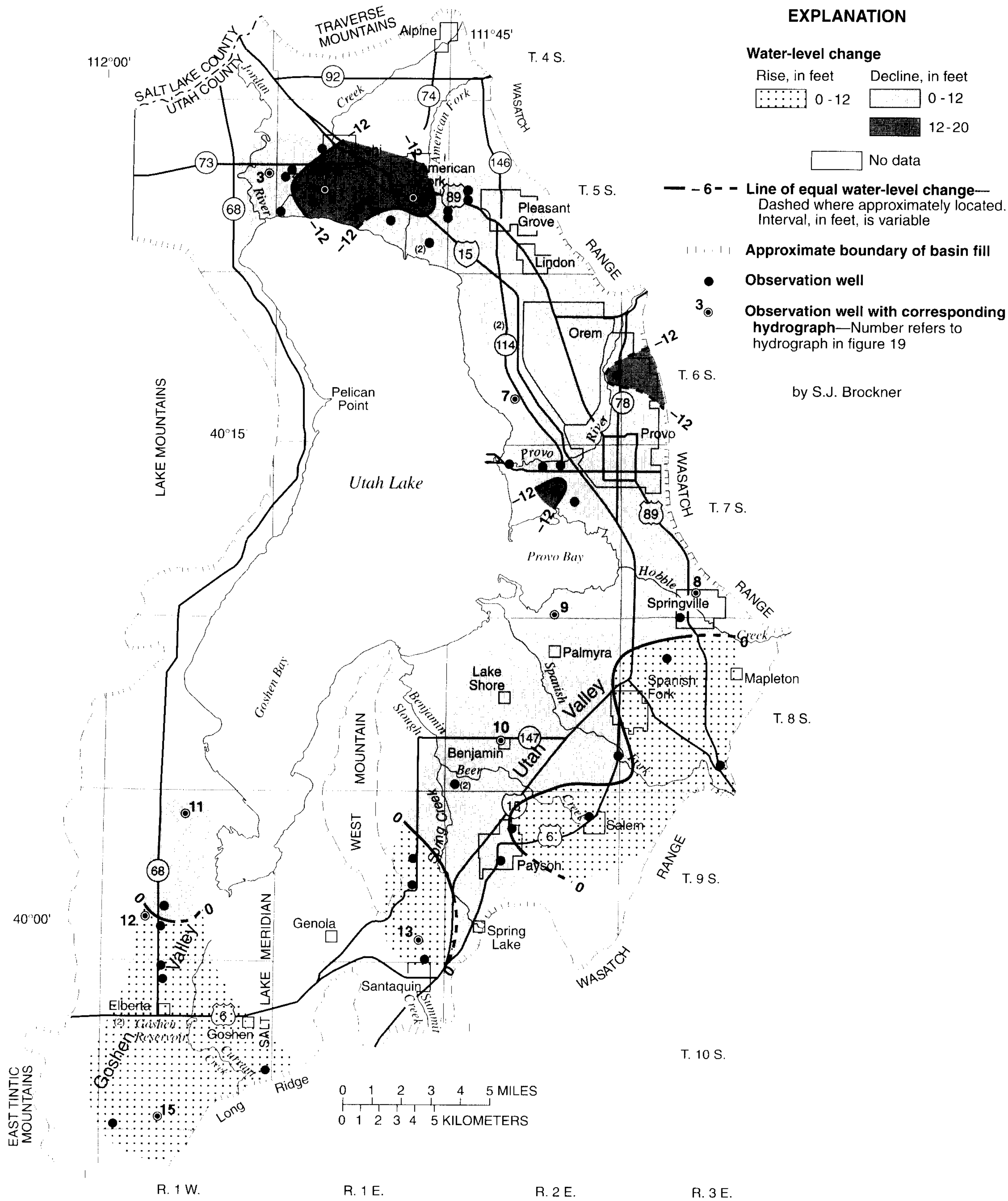


Figure 20. Map of Utah and Goshen Valleys showing change of water level from March 1970 to March 2000.

JUAB VALLEY

By R.J. Eacret

Juab Valley, which is about 30 miles long and averages about 4 miles wide, is in central Utah along the west side of the Wasatch Range and the San Pitch Mountains. The valley drains near both its northern and southern ends—in northern Juab Valley via Currant Creek into Utah Lake, and in southern Juab Valley via Chicken Creek into the Sevier River. The northern and southern parts of Juab Valley are separated topographically by Levan Ridge, a gentle rise near the midpoint of the valley floor.

The principal water-bearing formation in Juab Valley is the unconsolidated basin-fill deposits. Most of the recharge to the ground-water reservoir occurs on the eastern side of the valley along the Wasatch Range and the San Pitch Mountains. Ground water moves to the lower part of the valley and to eventual discharge points at the northern and southern ends of the valley. The ground-water divide between the northern and southern parts of Juab Valley is slightly south of Levan Ridge.

Ground water occurs in the basin-fill deposits under both water-table and artesian conditions, but artesian conditions are prevalent in the lower part of the valley. The greatest depths to water are along the eastern margin of the valley, where permeable alluvial fans extend from the mountains into the valley.

Total estimated withdrawal of water from pumped and flowing wells in Juab Valley in 1999 was about 14,000 acre-feet, which is 2,000 acre-feet more than was reported for 1998 and 7,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells in Juab Valley in which the water level was measured during March 2000 is shown in figure 21. The relation of the water level in selected wells to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1 is shown in figure 22. Water levels from March 1999 to March 2000 rose in one and fell in five of the six observation wells north of Levan Ridge and declined in three of four wells south of Levan Ridge. The decline in water levels probably resulted from increased withdrawals and less-than-average precipitation. Water levels in March generally rose from 1978 to their highest level in 1985. This rise corresponds to a period of greater-than-average precipitation during 1978-86. Water levels generally declined from 1986 to 1993 and generally have risen since 1993.

Water levels from March 1970 to March 2000 generally rose in the Mona area and northwest of Levan (fig. 23). The largest rise, about 7 feet, occurred north of Mona. Declines occurred west of Nephi and west of Levan. The greatest decline, about 10 feet, occurred southwest of Levan.

Precipitation at Nephi during 1999 was 14.13 inches, which is 0.39 inch less than the average annual precipitation for 1935-99, and 5.18 inches less than in 1998. The concentration of dissolved solids in water from well (D-13-1)7dbc-1 fluctuated during 1964-99 with a slight upward trend.

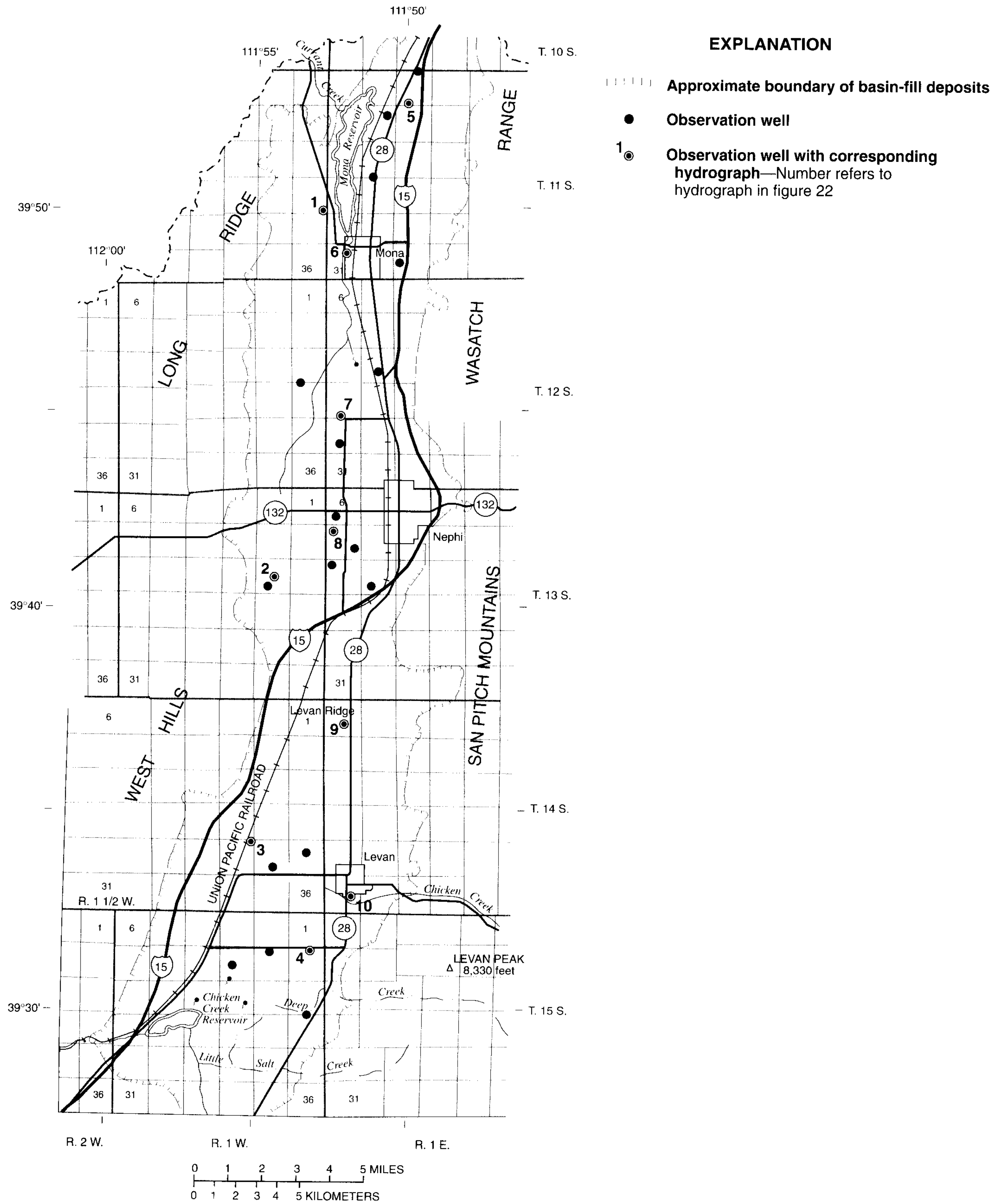


Figure 21. Location of wells in Juab Valley in which the water level was measured during March 2000.

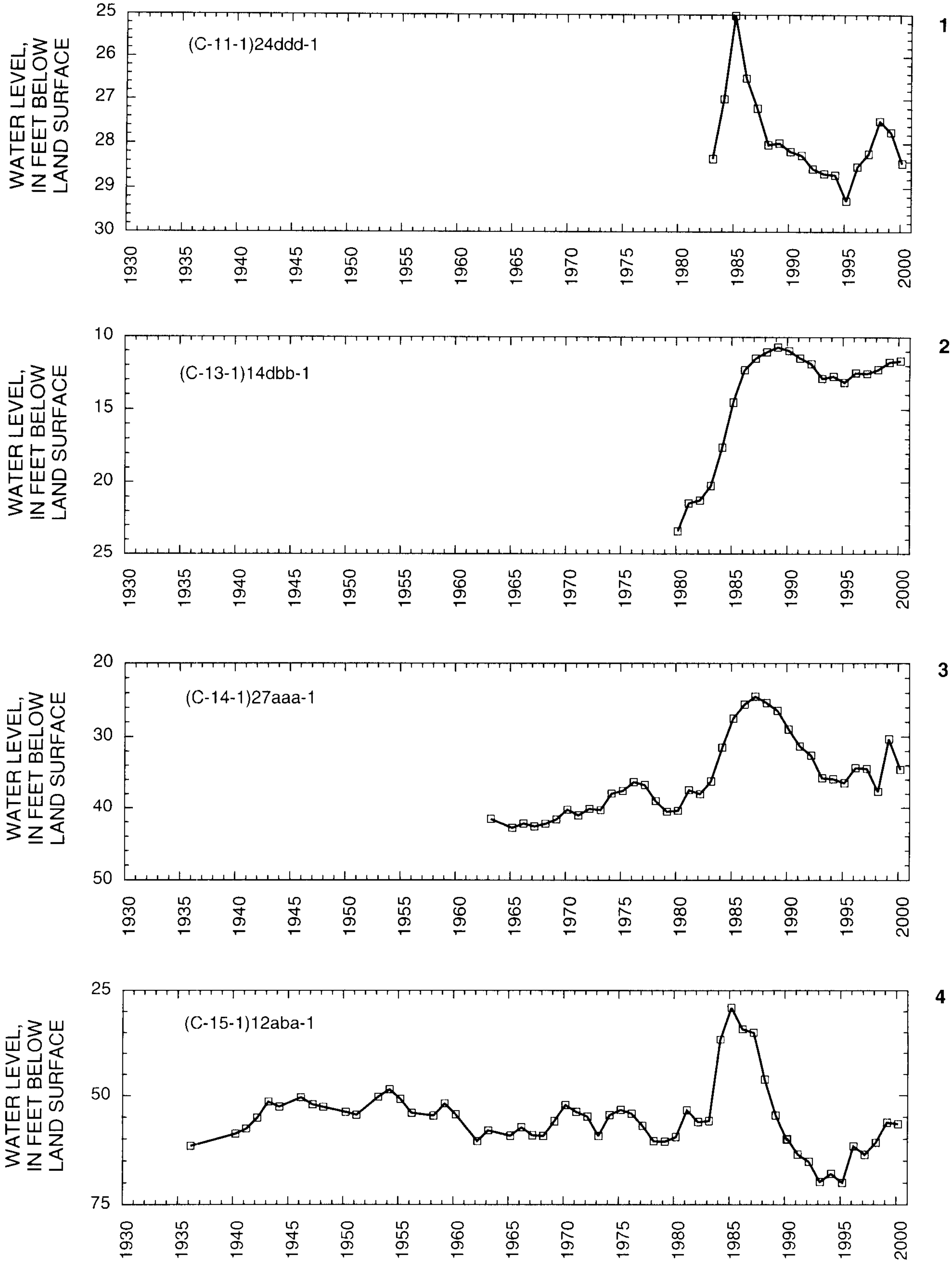


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1.

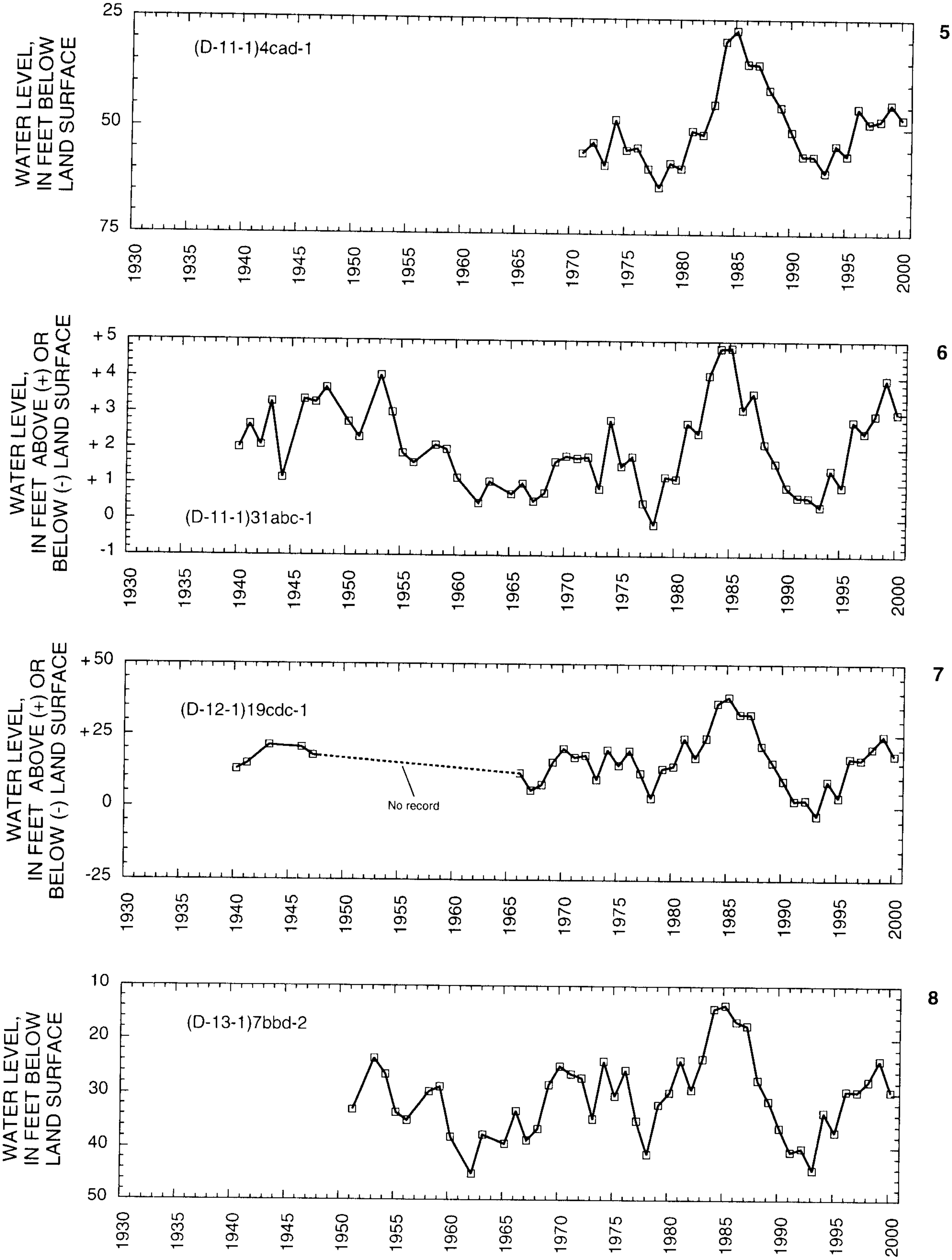
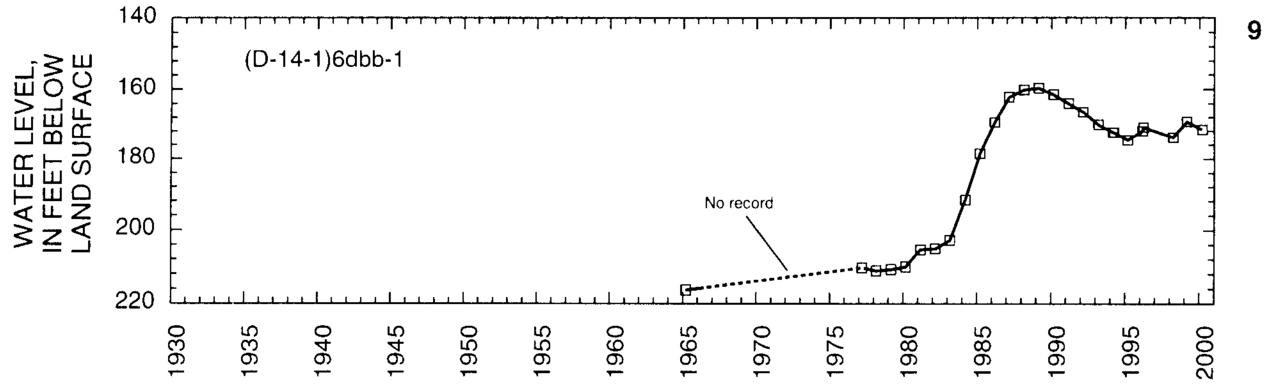


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.



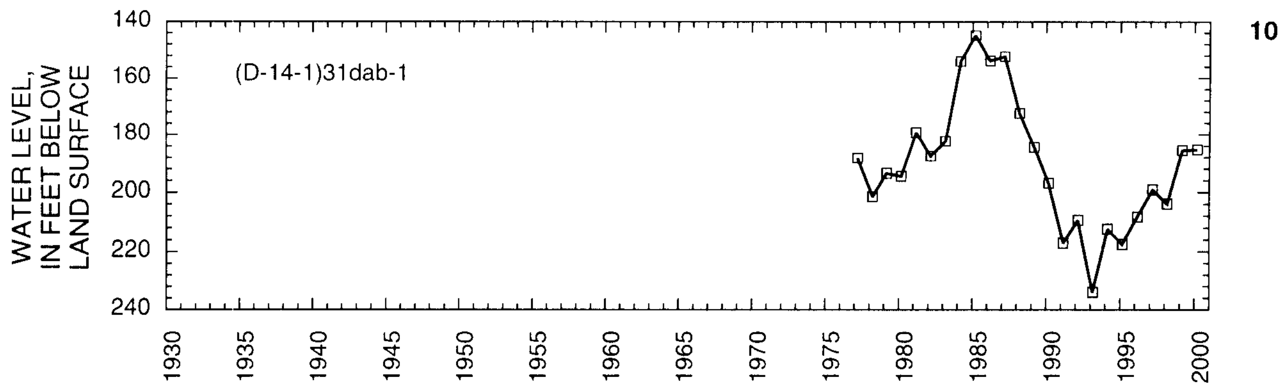


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.

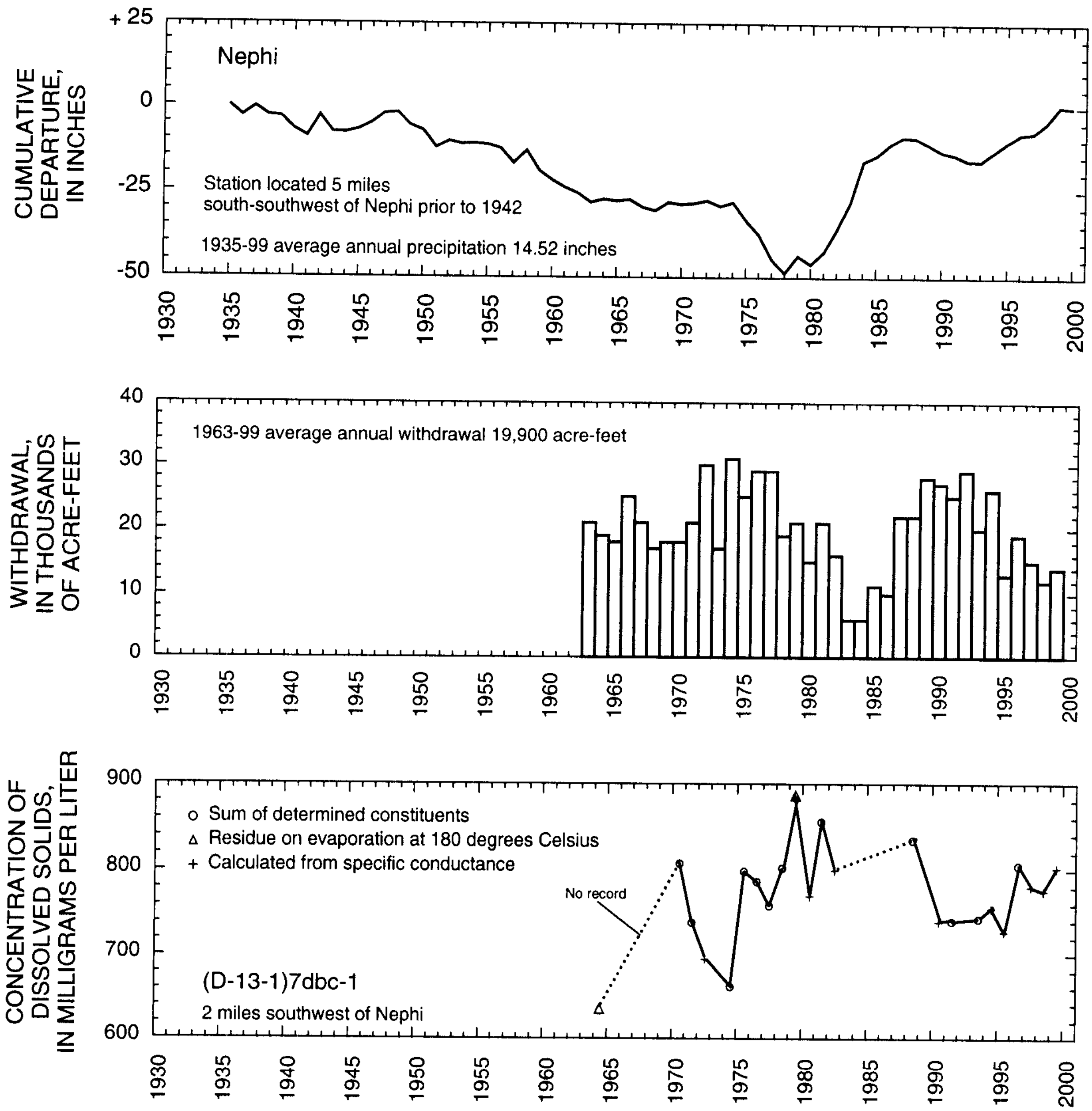


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.

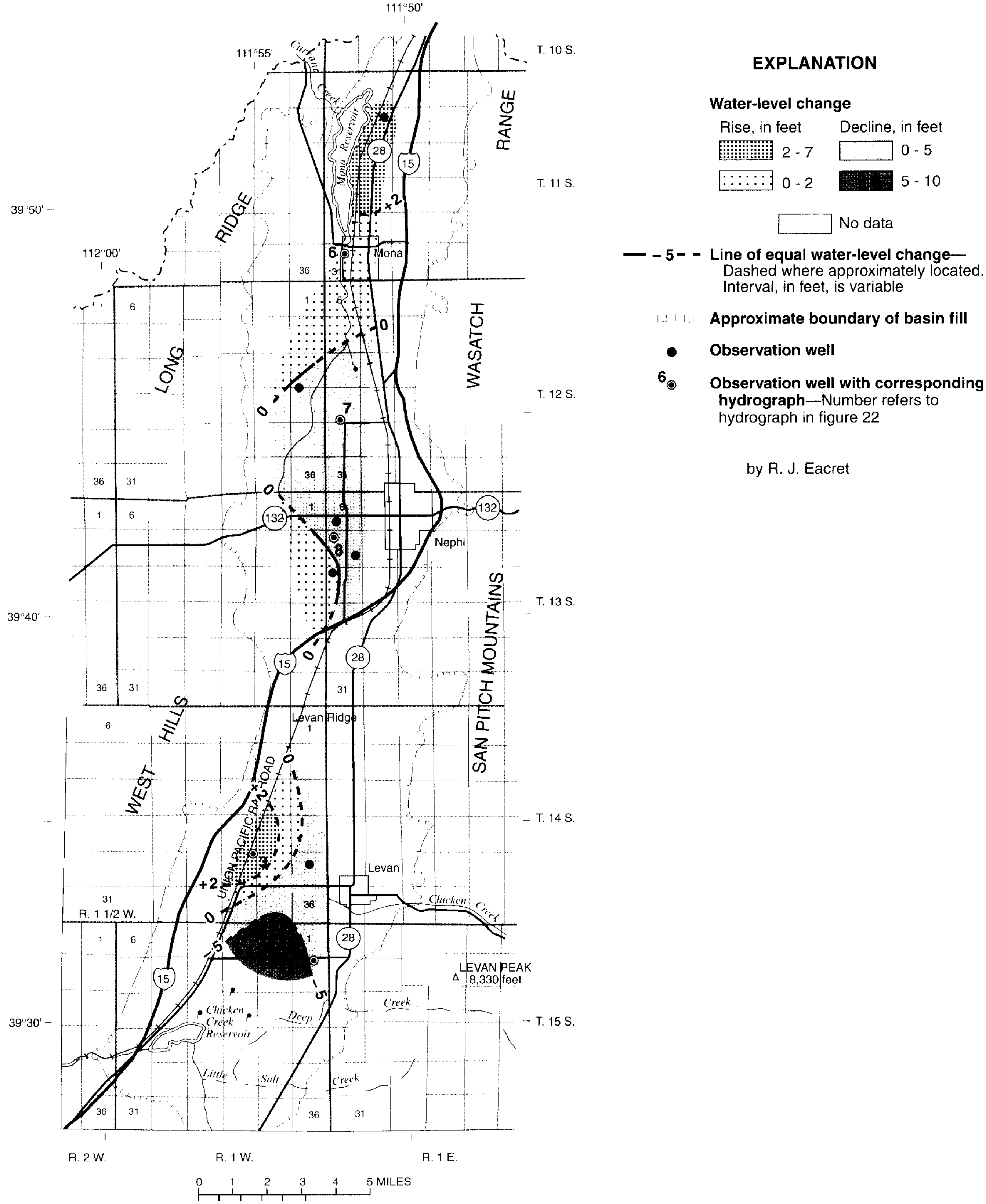


Figure 23. Map of Juab Valley showing change of water level from March 1970 to March 2000.

SEVIER DESERT

By Paul Downhour

The part of the Sevier Desert described here covers about 3,100 square miles. It is principally the broad, gently sloping area between the Canyon and Tintic Mountains on the east and the Drum Mountains on the west, and between Clear Lake and the north end of Sevier Lake on the south and the Sheeprock and Simpson Mountains on the north.

Ground water occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the ground water is discharged from wells tapping either of two artesian aquifers—the shallow or deep artesian aquifer.

Total estimated withdrawal of water from wells in the Sevier Desert in 1999 was about 12,000 acre-feet, which is the same amount as in1998 and about 13,000 acre-feet less than the 1989-98 average annual withdrawal (tables 2 and 3).

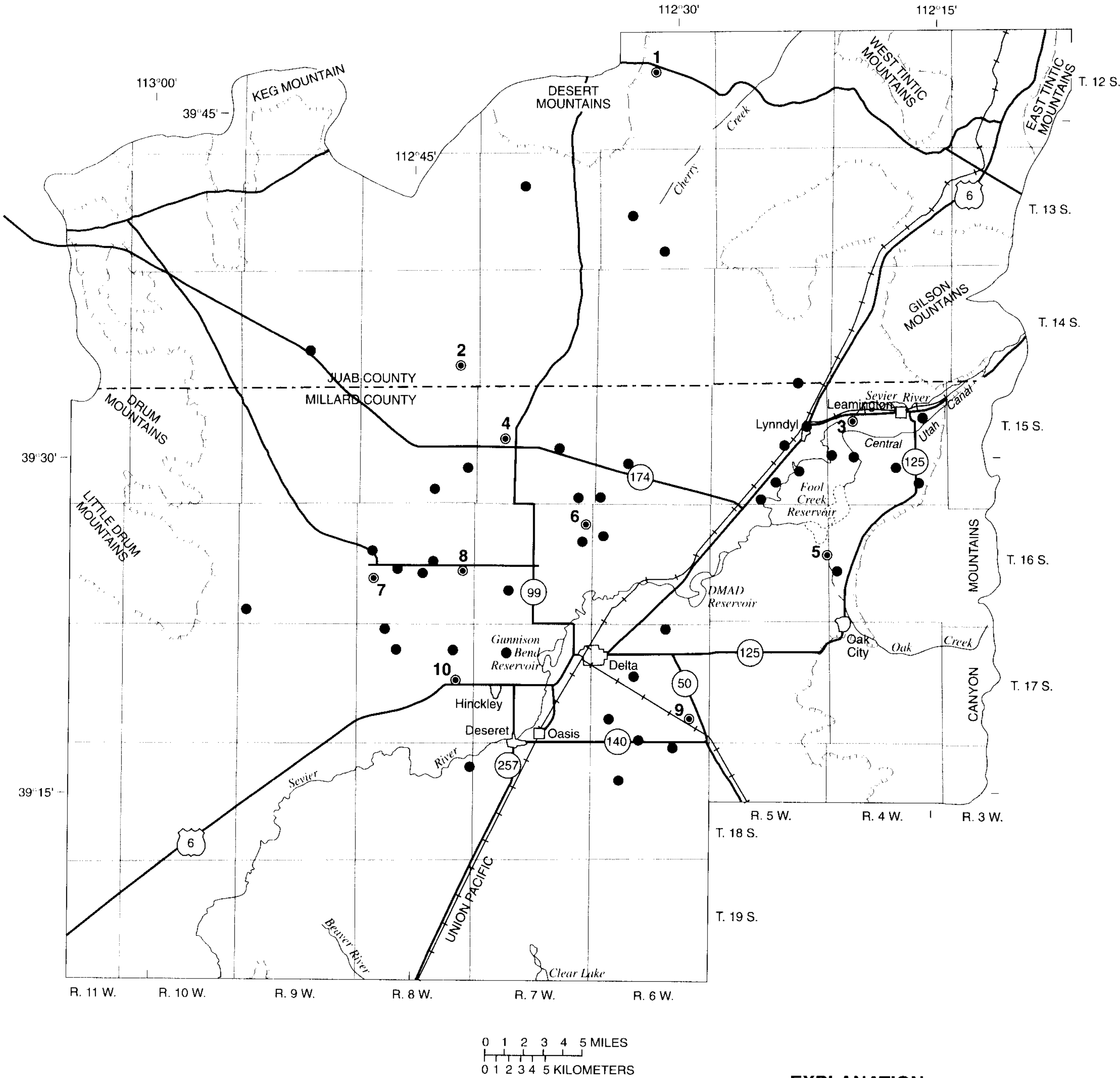
The location of wells in the Sevier Desert in which the water level was measured during March 2000 is shown in figures 24 and 25. The relation of the water level in selected wells to annual discharge of the Sevier River near Juab, to cumulative departure from the average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1 is shown in figure 26. Water levels in both the shallow and deep aquifers in the Sevier Desert rose from 1980 to 1987, which corresponds to a period of greater-than-average precipitation and less-than-average withdrawal. Water levels in both aquifers began declining during 1987-90 and continued to decline until 1995. Levels have generally risen or remained stable since 1995. Rises since 1995 probably resulted from decreased withdrawal, greater-than-average precipitation, and more available surface water for irrigation.

Water levels generally declined in the shallow and deep artesian aquifers from March 1970 to March 2000 (figs. 27 and 28). Declines of nearly 6 feet in the shallow artesian aquifer, and nearly 7 feet in the deep artesian aquifer, occurred in the Delta area. The decline in water levels probably is the result of continued withdrawals of ground water. Rises in water levels in the shallow artesian aquifer occurred in the northern, western, and eastern parts of the areas. The largest rise in the shallow artesian aquifer, about 14 feet, occurred in a well north of Oak City. Rises up to 4 feet in the deep artesian aquifer occurred in the outer areas east and west of Delta. The rises may be a result of reduced local withdrawals and greater-than-average precipitation.

Discharge of the Sevier River in 1999 was 228,700 acre-feet, 81,800 acre-feet less than in 1998 and 44,200 acre-feet more than the long-term average (1935-99).

Precipitation at Oak City was 13.70 inches in 1999, 0.67 inch more than the 1935-99 average annual precipitation and 6.61 inches less than in 1998.

The concentration of dissolved solids in water from well (C-15-4)18daa-1, near Lynndyl, has increased from about 900 milligrams per liter in 1958 to about 1,900 milligrams per liter in 1996.



EXPLANATION

Approximate boundary of basin-fill deposits

Observation well

9 **Observation well with corresponding hydrograph**—Number refers to hydrograph in figure 26

Figure 24. Location of wells in the shallow artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2000.

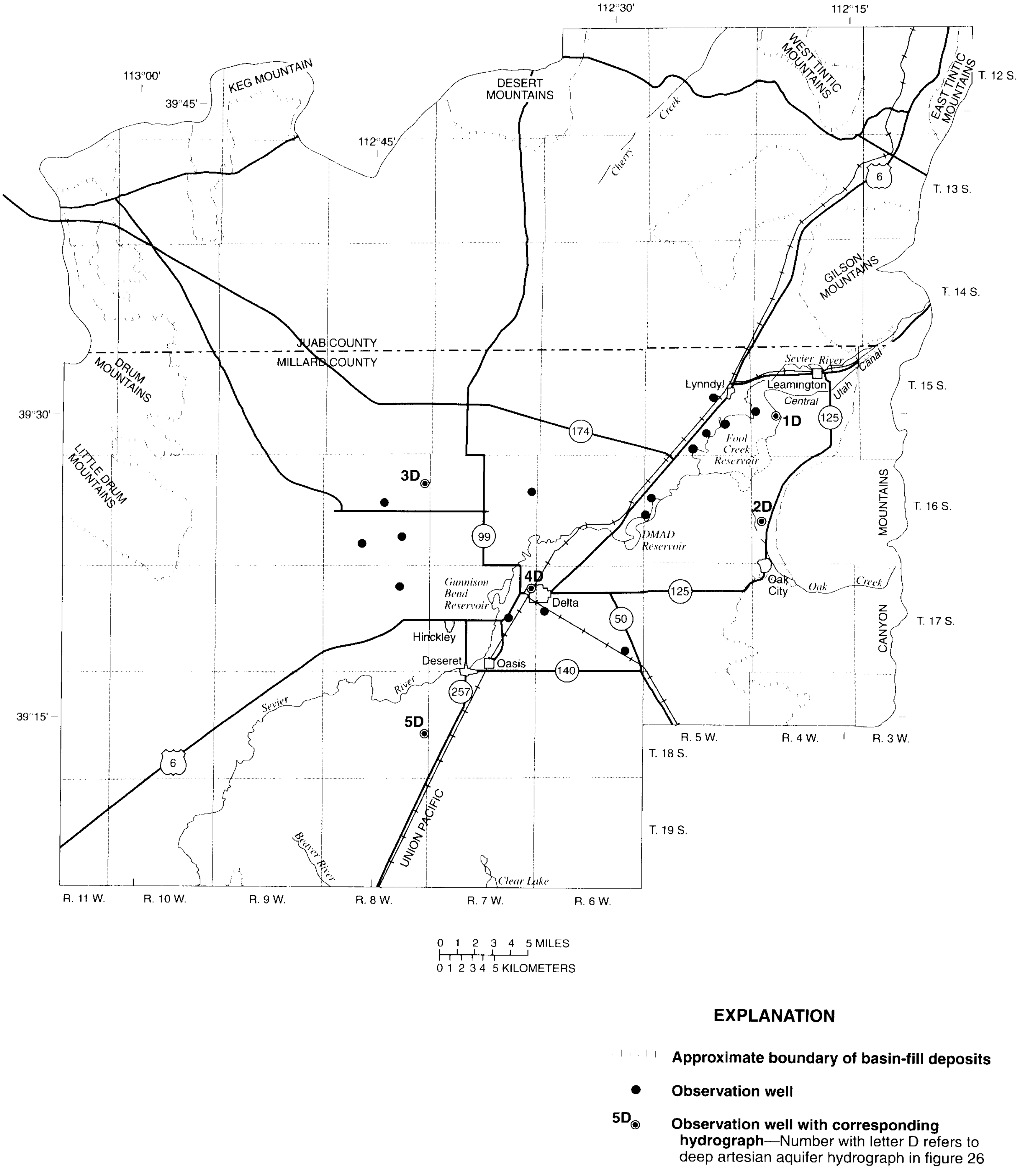


Figure 25. Location of wells in the deep artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2000.

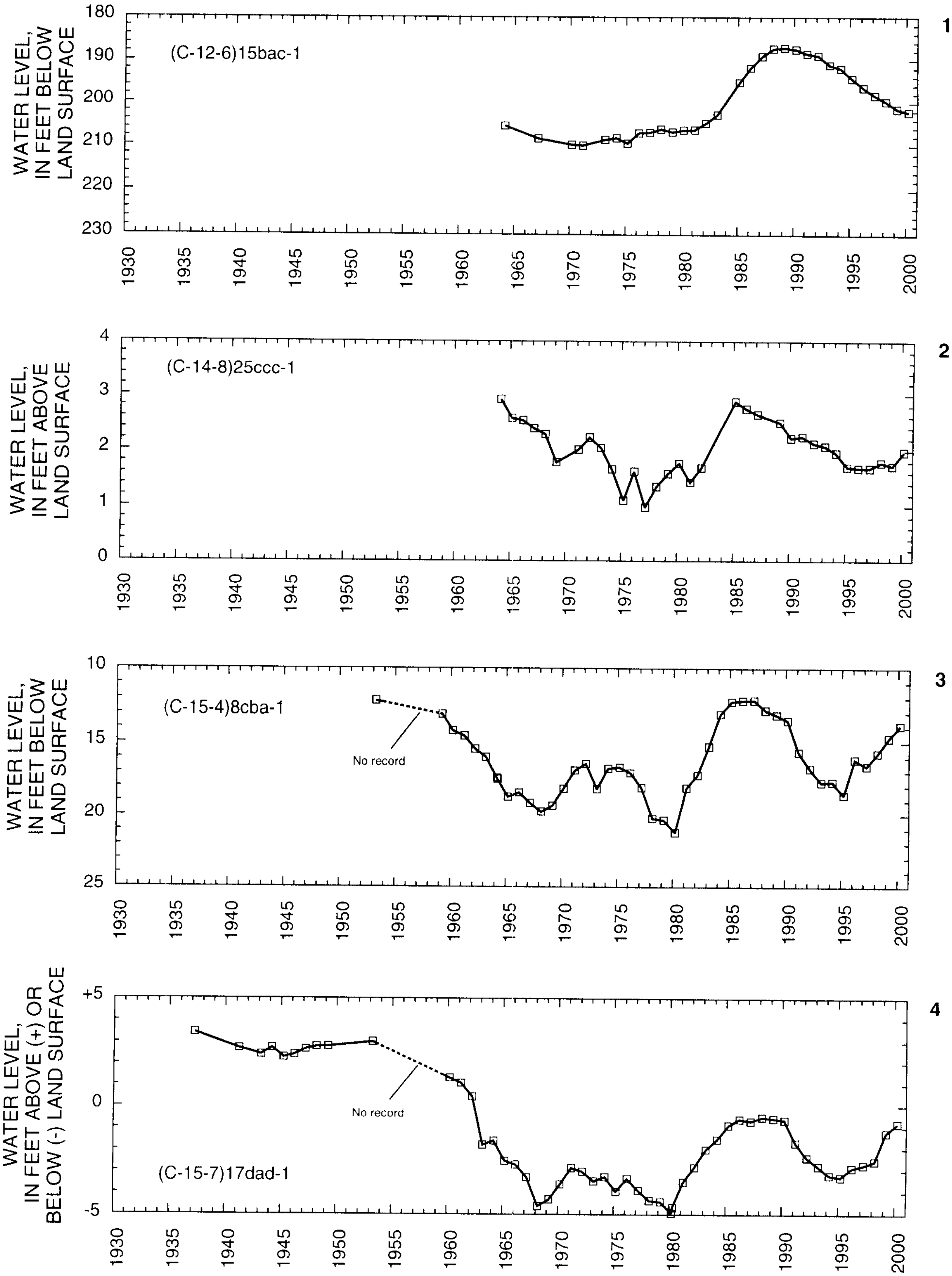


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1.

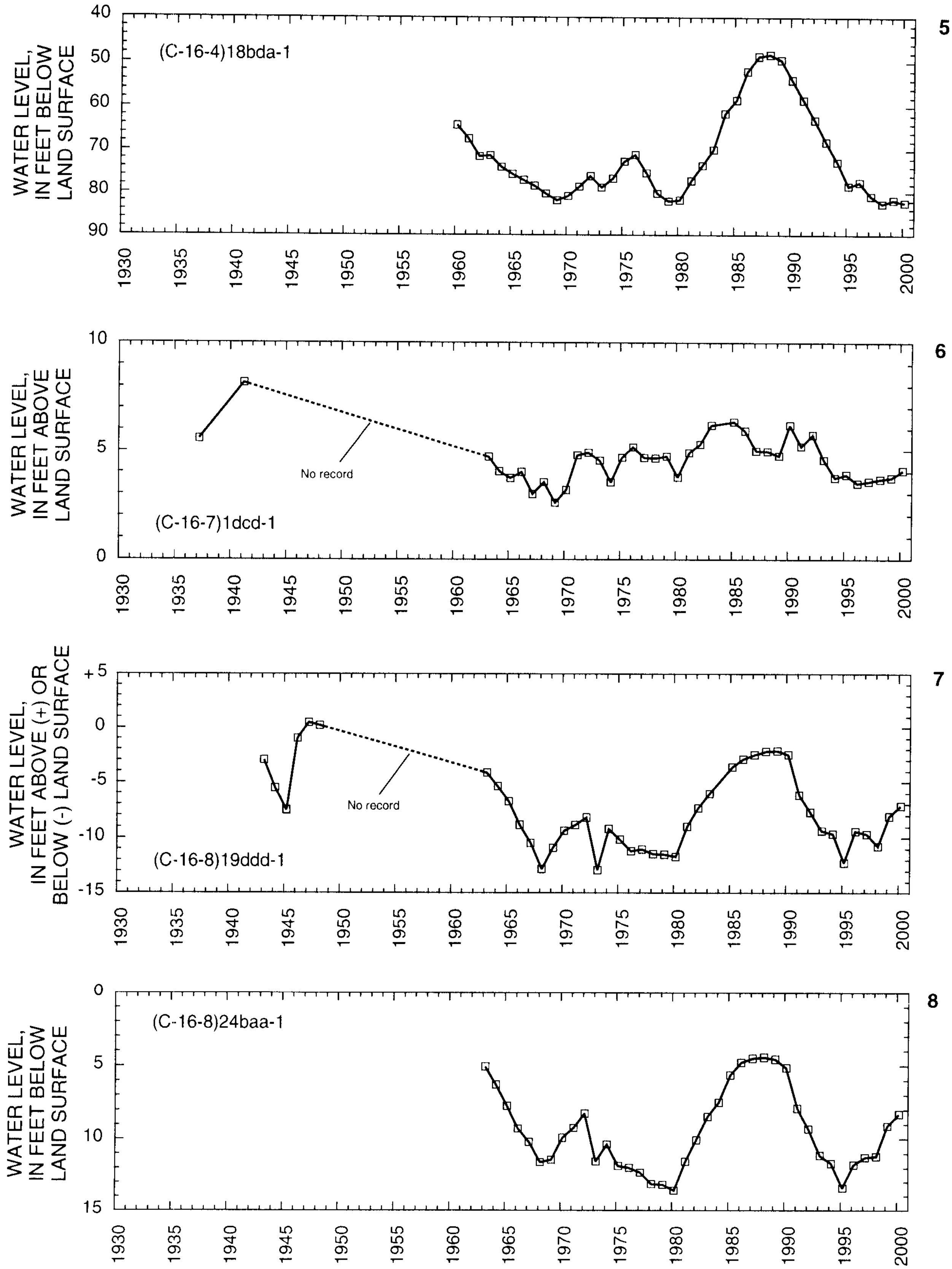
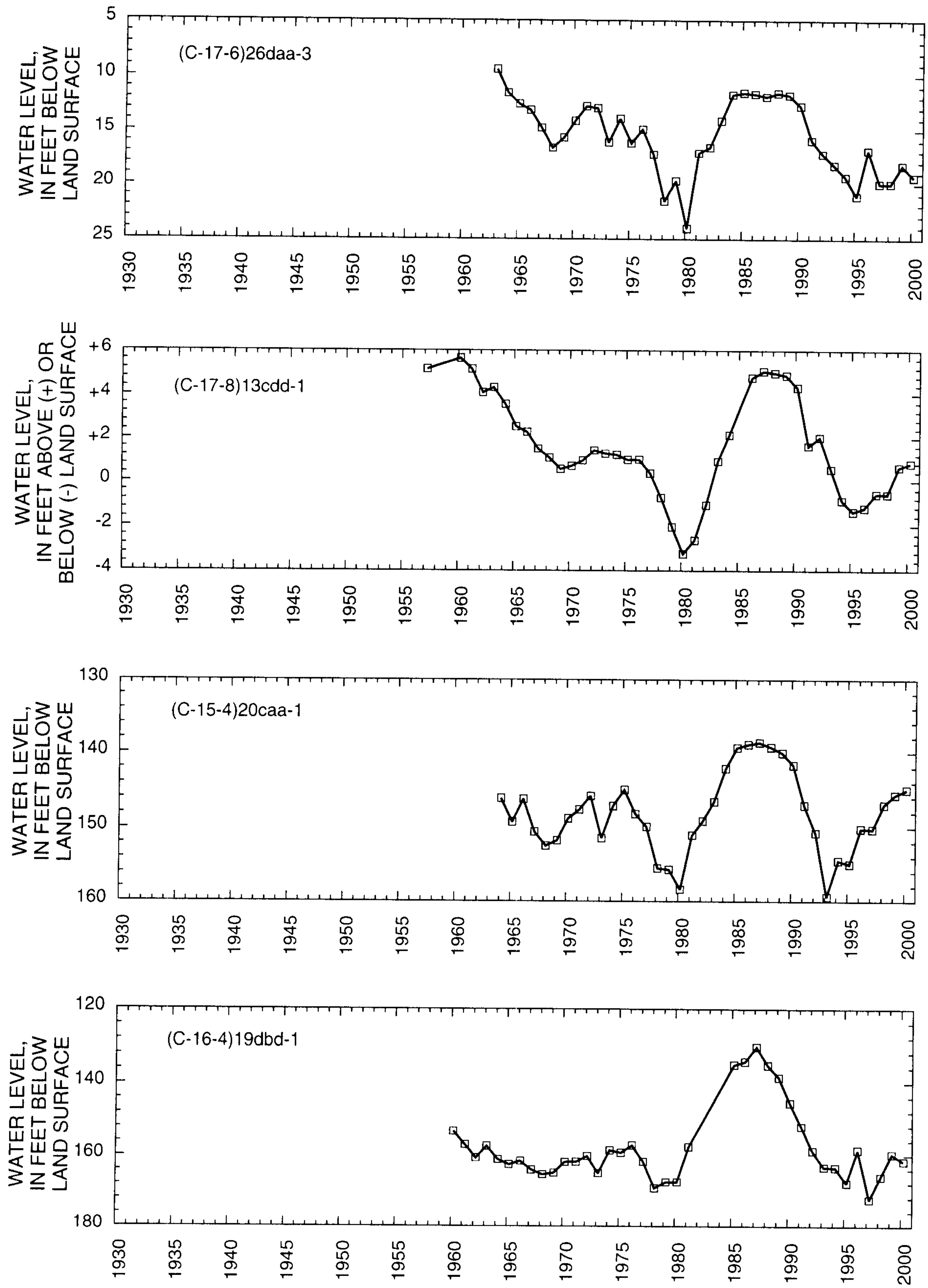


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.



9

10

1D

2D

Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

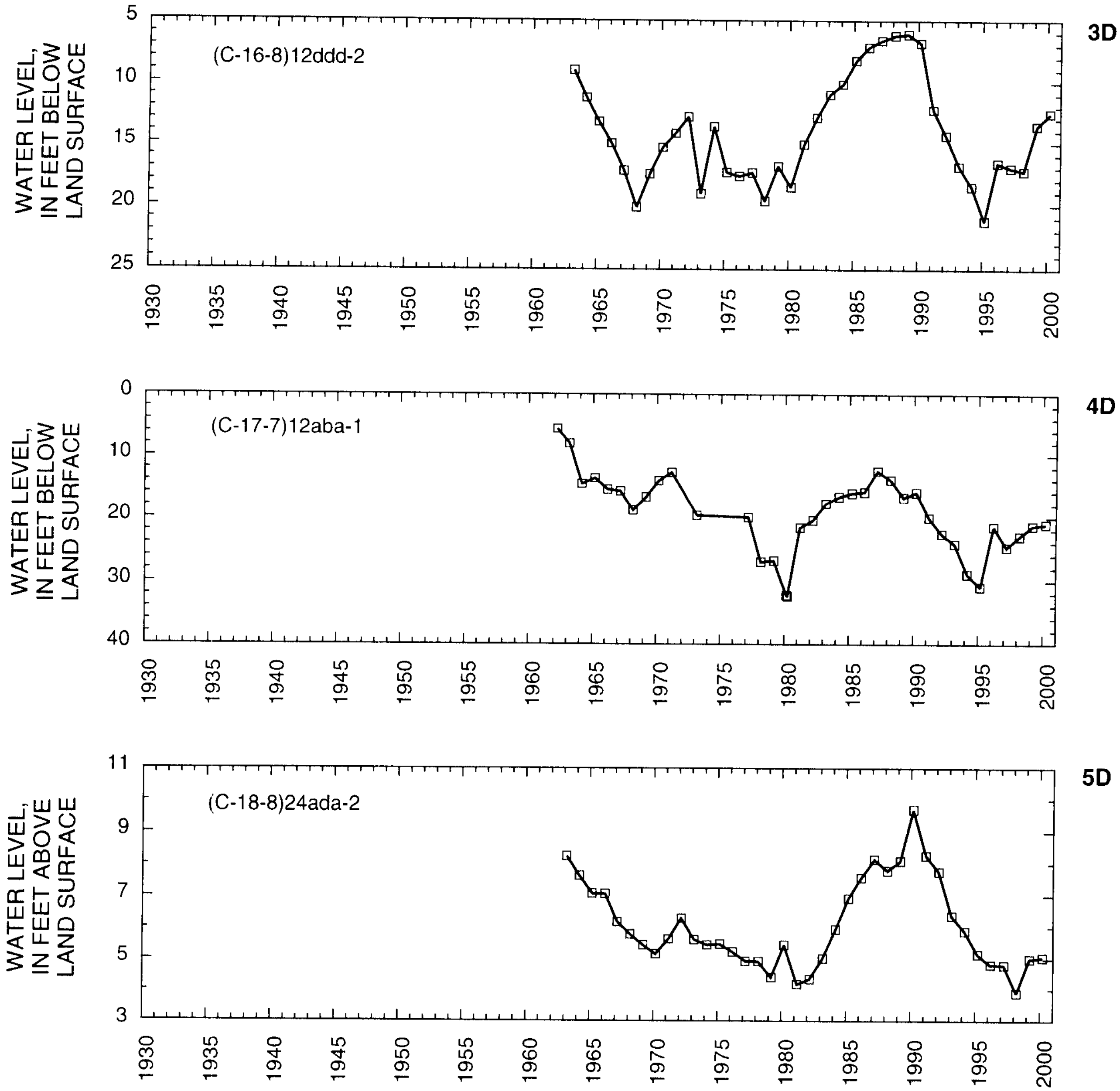


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

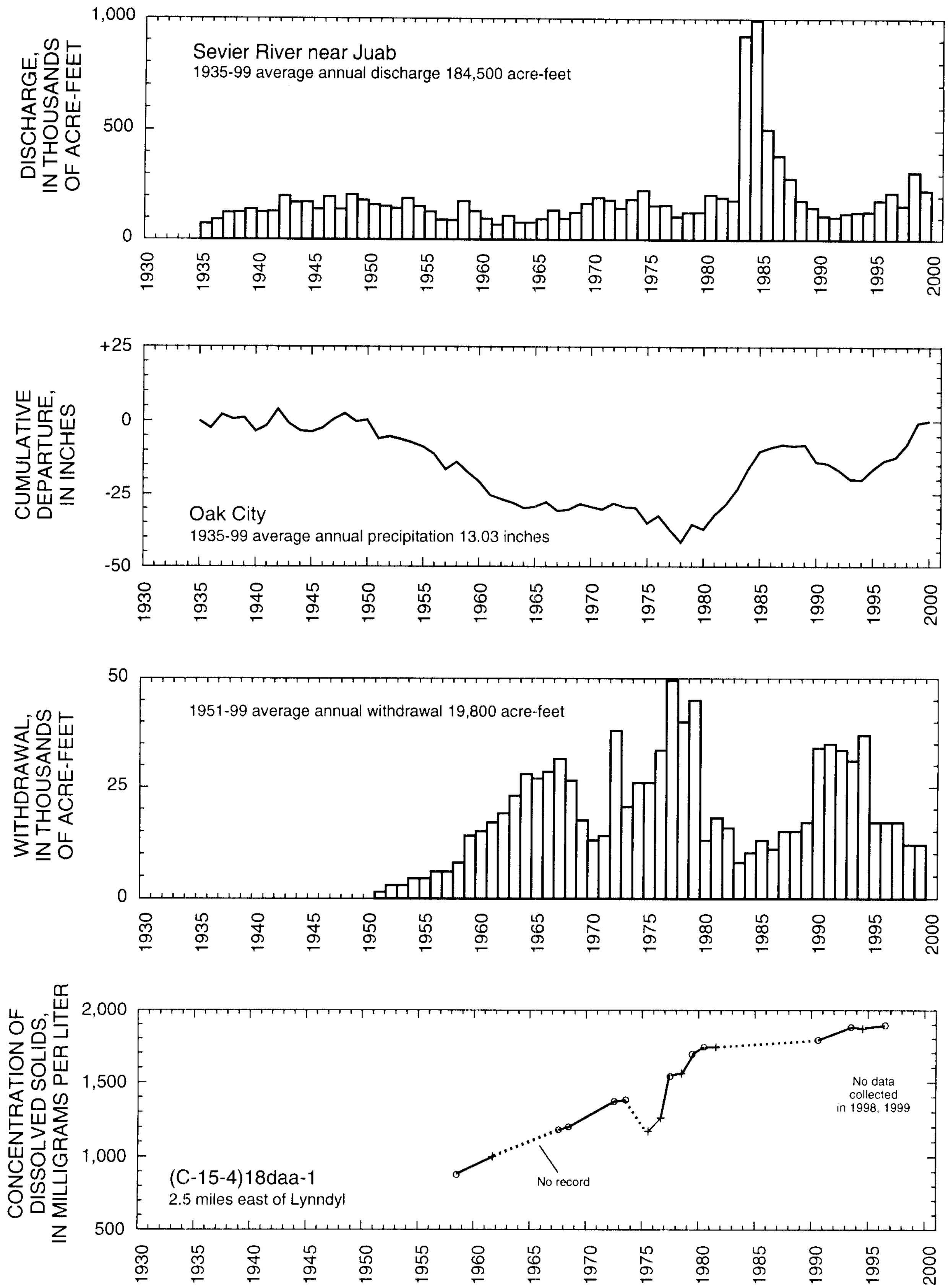


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

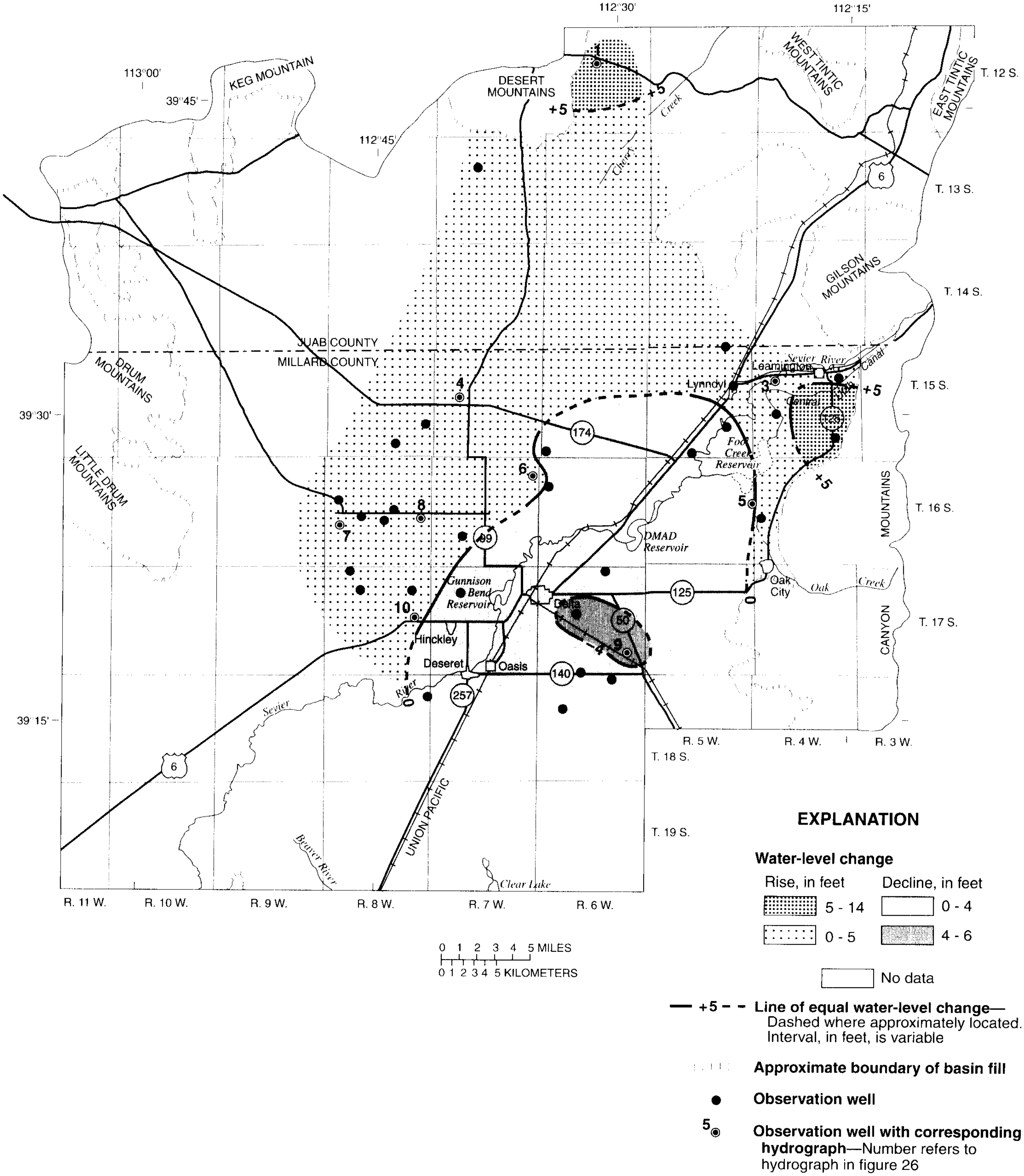
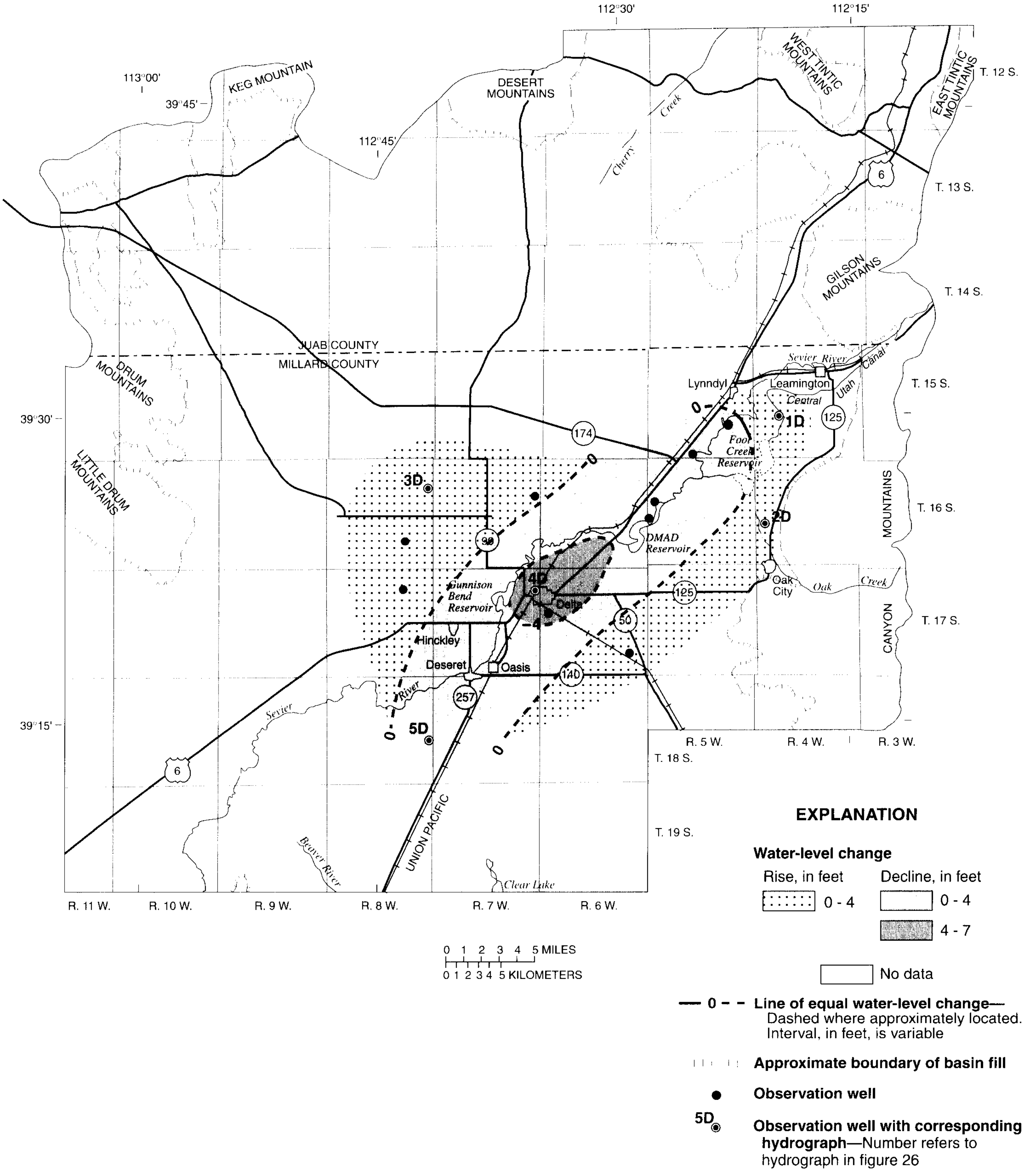


Figure 27. Map of part of the Sevier Desert showing change of water level in the shallow artesian aquifer from March 1970 to March 2000.



by Paul Downhour

Figure 28. Map of part of the Sevier Desert showing change of water level in the deep artesian aquifer from March 1970 to March 2000.

CENTRAL SEVIER VALLEY

By B.A. Slaugh

The central Sevier Valley is in south-central Utah, surrounded by the Sevier, Wasatch, and Gunnison Plateaus to the east and the Tushar Mountains, Valley Mountains, and Pahvant Range to the west. Altitude ranges from 5,100 feet on the valley floor at the north end of the valley near Gunnison to about 12,000 feet in the Tushar Mountains.

Total estimated withdrawal of water from wells in central Sevier Valley in 1999 was about 20,000 acre-feet, which is the same amount that was reported for 1998, and 1,000 acre-feet more than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells in the central Sevier Valley in which the water level was measured during March 2000 is shown in figure 29. The relation of the water level in selected wells to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4 is shown in figure 30. Long-term hydrographs for selected wells in the central Sevier Valley show that March water levels generally rose from about 1978 to 1985, declined from 1985 to about 1993, and have been somewhat stable since 1993. Water-level rises during 1978-85 were probably the result of greater-than-average precipitation during the same period and recharge from the Sevier River.

Water levels generally rose from March 1970 to March 2000 in the central Sevier Valley in areas where data are available (fig. 31). The greatest rise, 8.4 feet, was observed west of Gunnison. Rises of about 3 feet were measured in the central and southern areas of the central Sevier Valley.

Discharge of the Sevier River at Hatch in 1999 was about 70,200 acre-feet. This is about 58,000 acre-feet less than the 128,200 acre-feet for 1998 and about 9,500 acre-feet less than the 1940-99 average annual discharge.

Precipitation at Richfield was 7.99 inches in 1999, which is 0.17 inch less than the 1950-99 average annual precipitation and 2.14 inches less than in 1998. Concentration of dissolved solids in water from well (C-23-2)15dcb-4 decreased from about 600 milligrams per liter to about 400 milligrams per liter during 1987-95, which was the concentration during 1955-59. The concentration of dissolved solids for 1999 was 458 milligrams per liter.

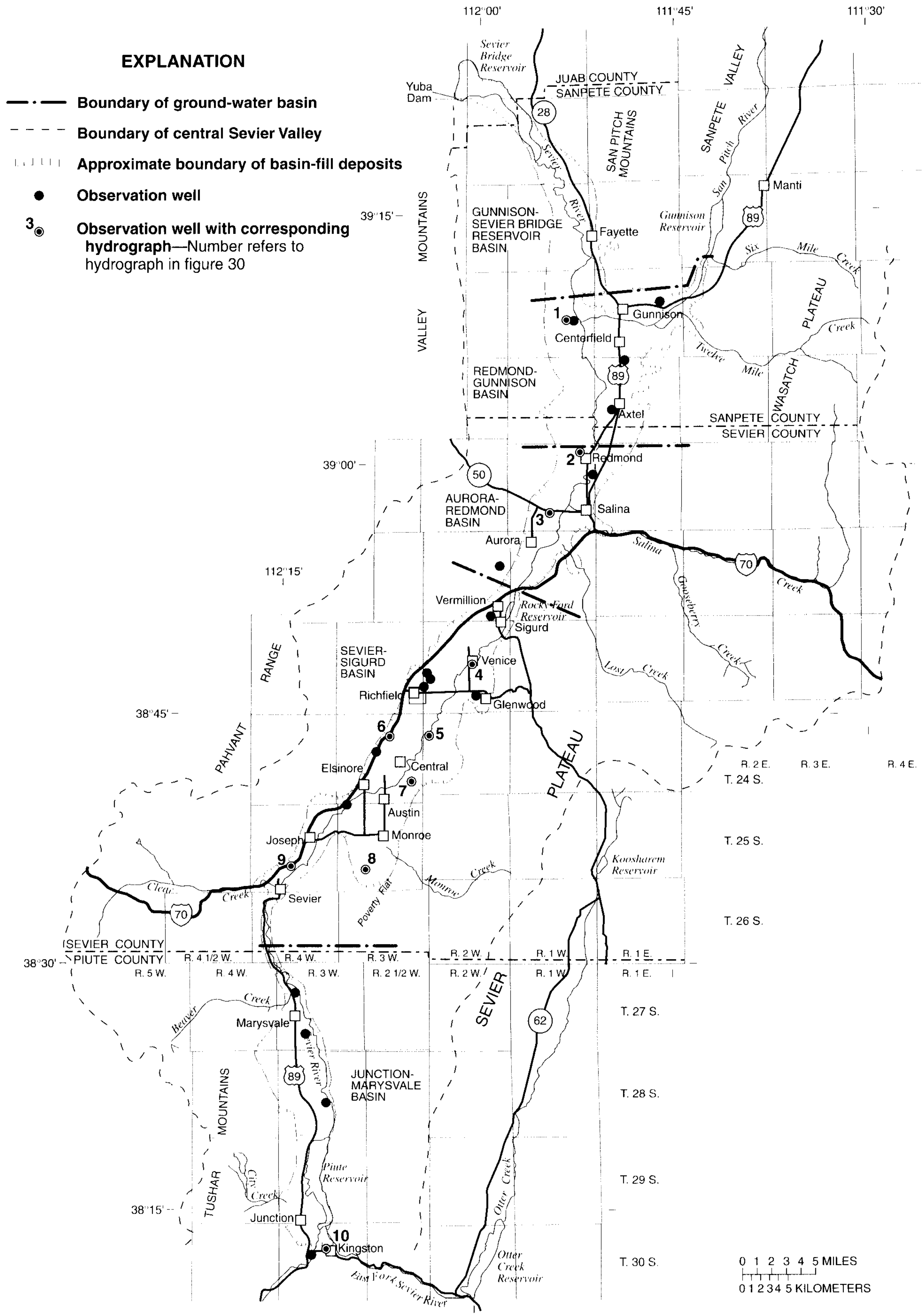


Figure 29. Location of wells in central Sevier Valley in which the water level was measured during March 2000.

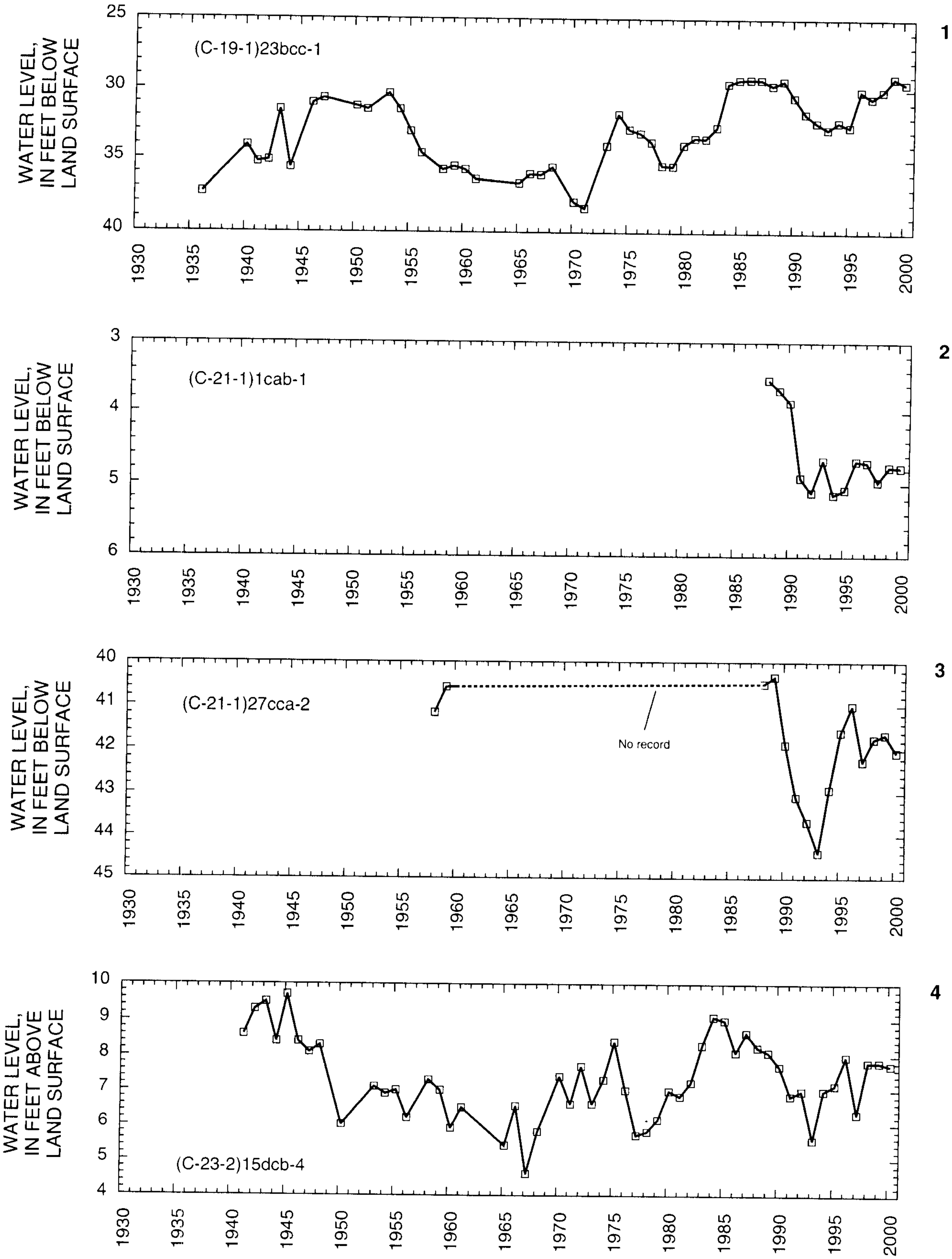


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.

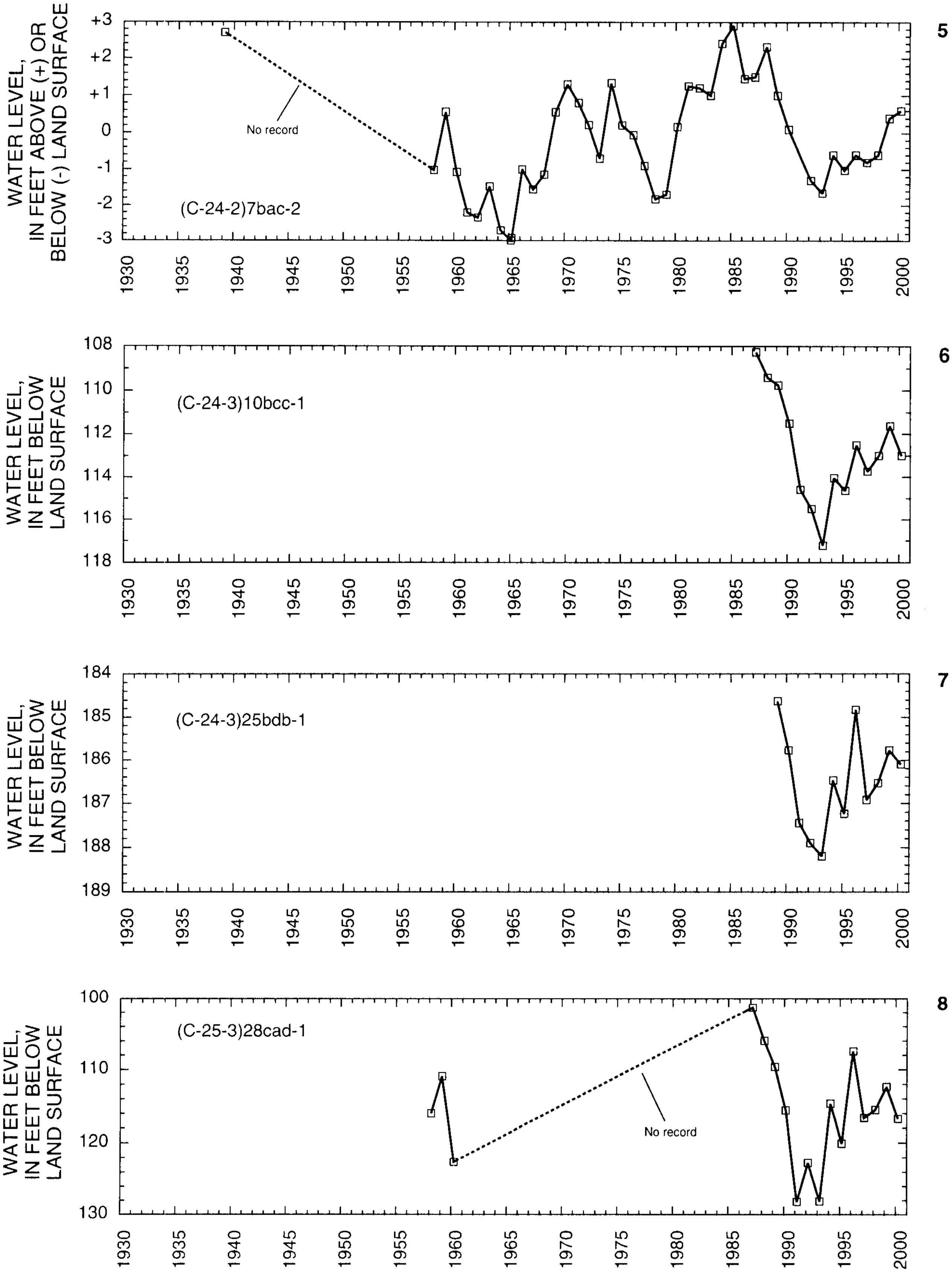
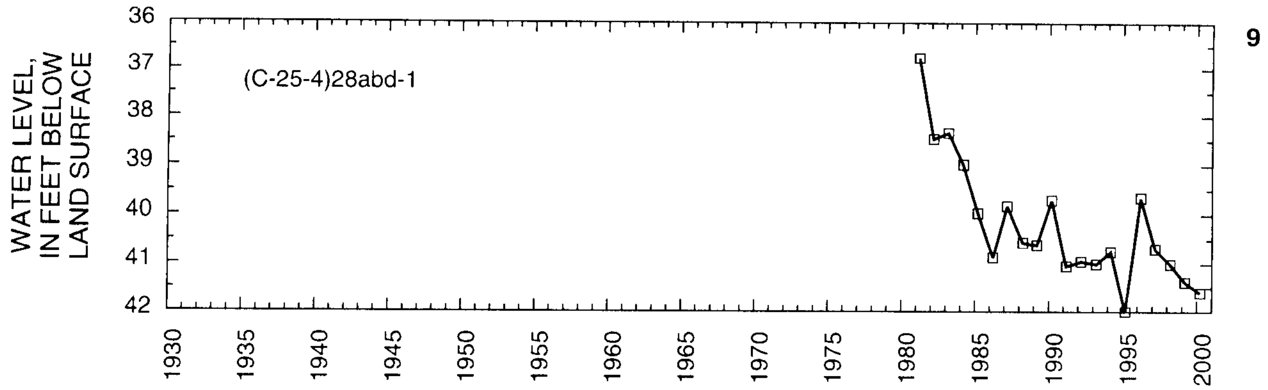


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.



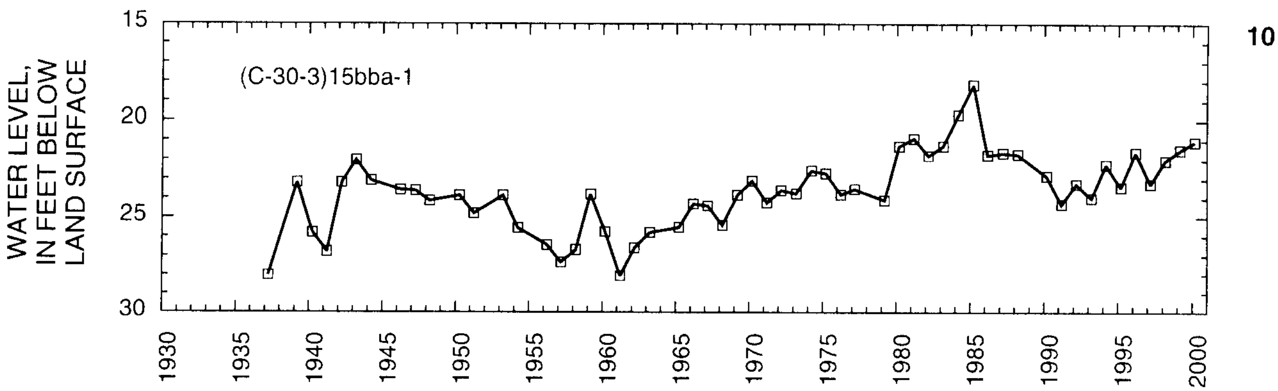


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

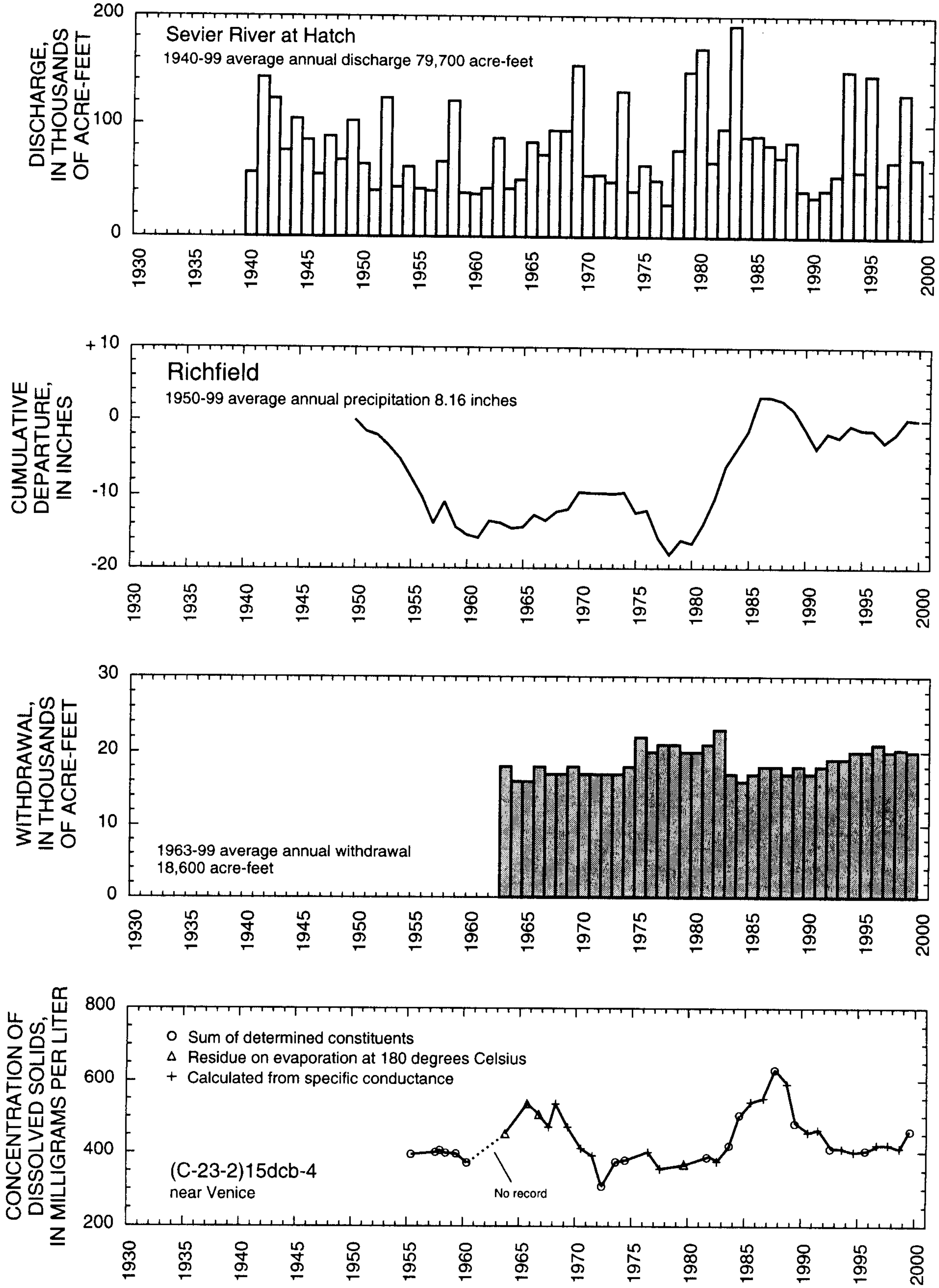


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

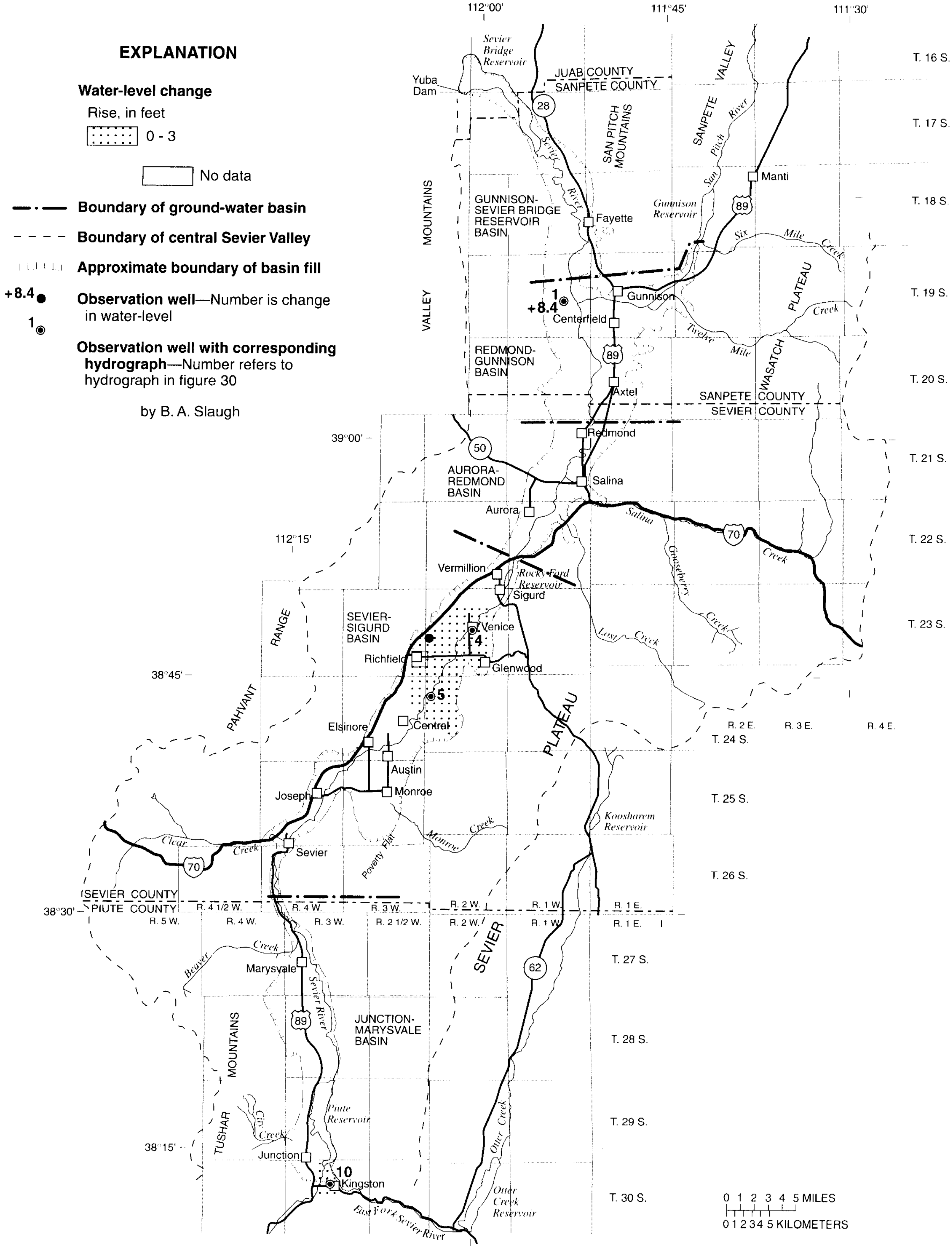


Figure 31. Map of central Sevier Valley showing change of water level from March 1970 to March 2000.

PAHVANT VALLEY

By R.L. Swenson

Pahvant Valley, in southeast Millard County, extends from the vicinity of McCornick on the north to Kanosh on the south, from the Pahvant Range and Canyon Mountains on the east and northeast to a low basalt ridge on the west. The area of the valley is about 300 square miles, and water drains to the valley from about 500 square miles of the mountainous terrain. The valley is undrained on the surface south of the southern edge of T. 20 S.; north of this line, the surface is an undulating plain covered with sand dunes from which there is little or no surface drainage.

Total estimated withdrawal of water from wells in Pahvant Valley in 1999 was about 76,000 acre-feet, which is 10,000 acre-feet more than was reported in 1998 and 4,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3). Withdrawal for irrigation increased by 10,100 acre-feet to 74,500 acre-feet from 1998 to 1999, resulting from less-than-average precipitation and a decreased availability of surface water. Withdrawal for geothermal power generation was about 530 acre-feet and is reported as industrial withdrawal.

The location of wells in Pahvant Valley in which water levels were measured during March 2000 is shown in figure 32. The relation of the water level in selected wells to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 33. Water levels generally declined since the early 1950s until 1982 as a result of generally less-than-average precipitation and increased withdrawals. Water levels generally rose from 1982 to 1985, and were generally higher than in the early1950s, because of greater-than-average precipitation and decreased withdrawal for irrigation. Levels generally have declined since 1985 because of continued large withdrawals for irrigation. Levels generally declined from March 1999 to March 2000 because of less-than-average precipitation. Rises occurred in some areas as a result of decreased local withdrawals.

Water levels from March 1970 to March 2000 generally declined in the northern part of the valley and rose in the southern part (fig. 34). The declines probably are related to continued large withdrawals of ground water. Declines of about 49 feet occurred southeast of McCornick. Rises in water level of about 28 feet occurred north of Meadow and in an area southwest of Kanosh. Rises are probably related to decreased local withdrawals.

Precipitation at Fillmore during 1999 was 14.66 inches, which is 0.42 inch less than the average annual precipitation for 1931-99 and 5.16 inches less than in 1998.

The concentration of dissolved solids in water from wells near Flowell and west of Kanosh is shown in figure 23. The concentration of dissolved solids in water from well (C-21-5)7cdd-3, northwest of Flowell, has shown little change since 1983. The concentration of dissolved solids in water from well (C-23-6)21bdd-1, west of Kanosh, generally has increased since the late 1950s.

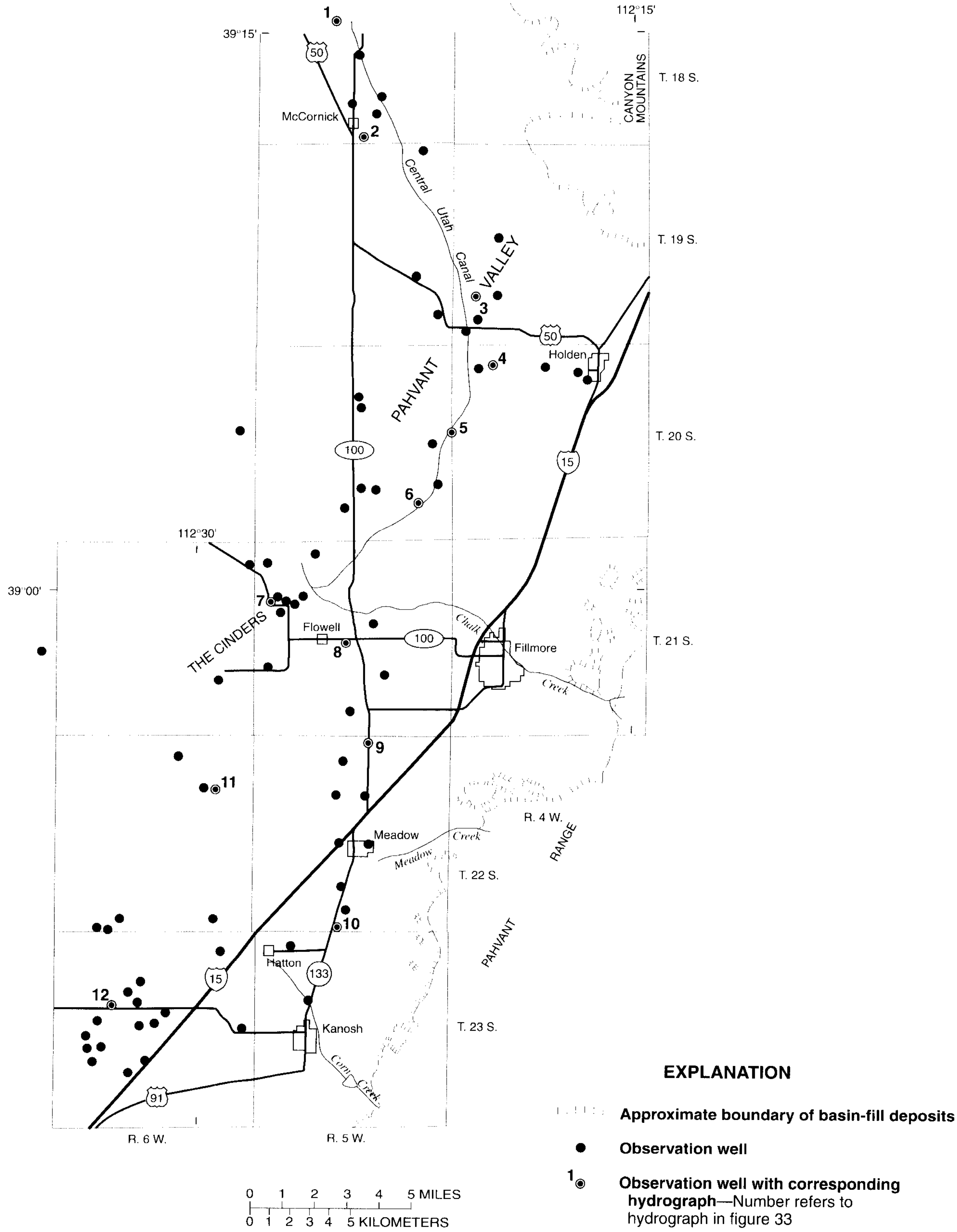


Figure 32. Location of wells in Pahvant Valley in which the water level was measured during March 2000.

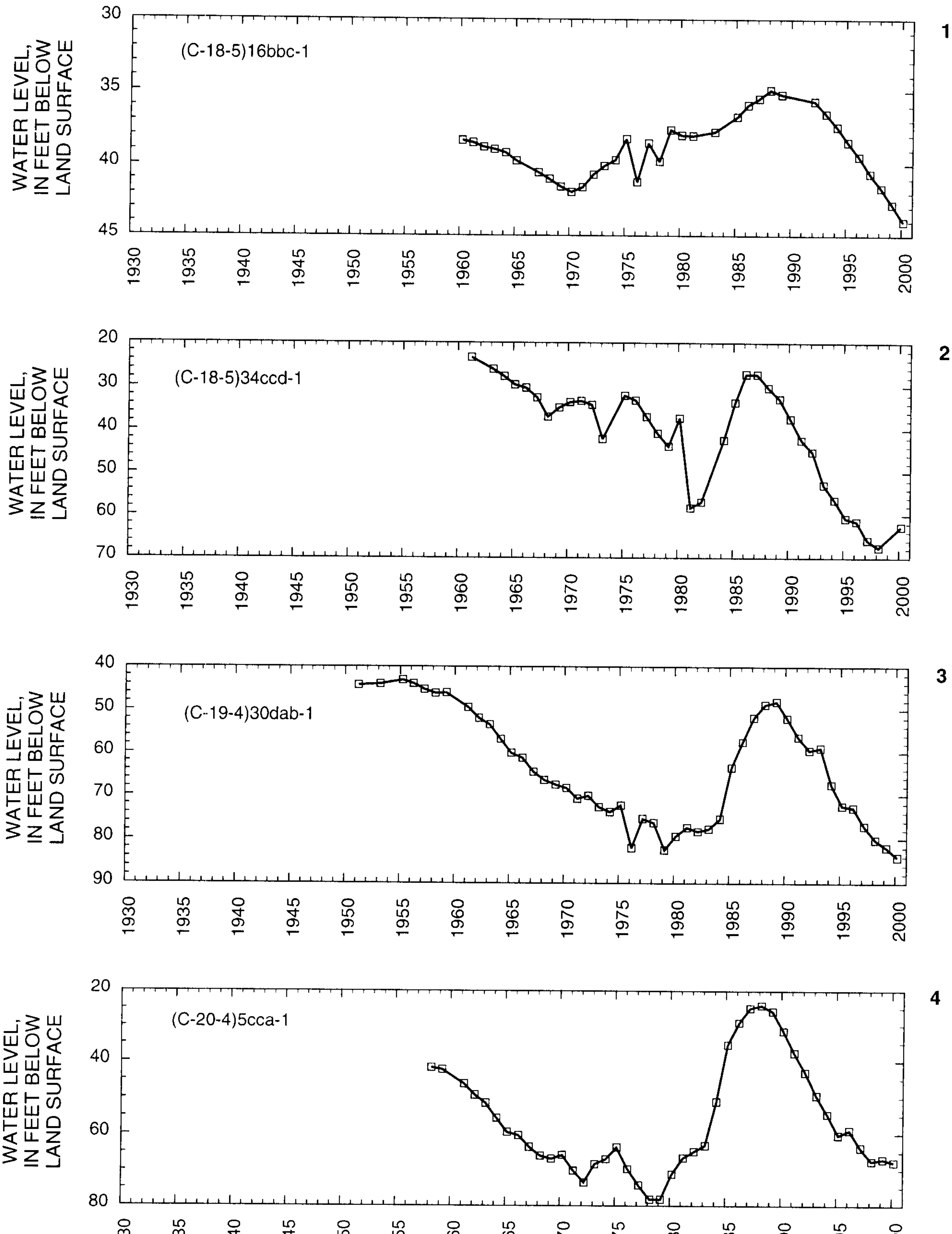


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

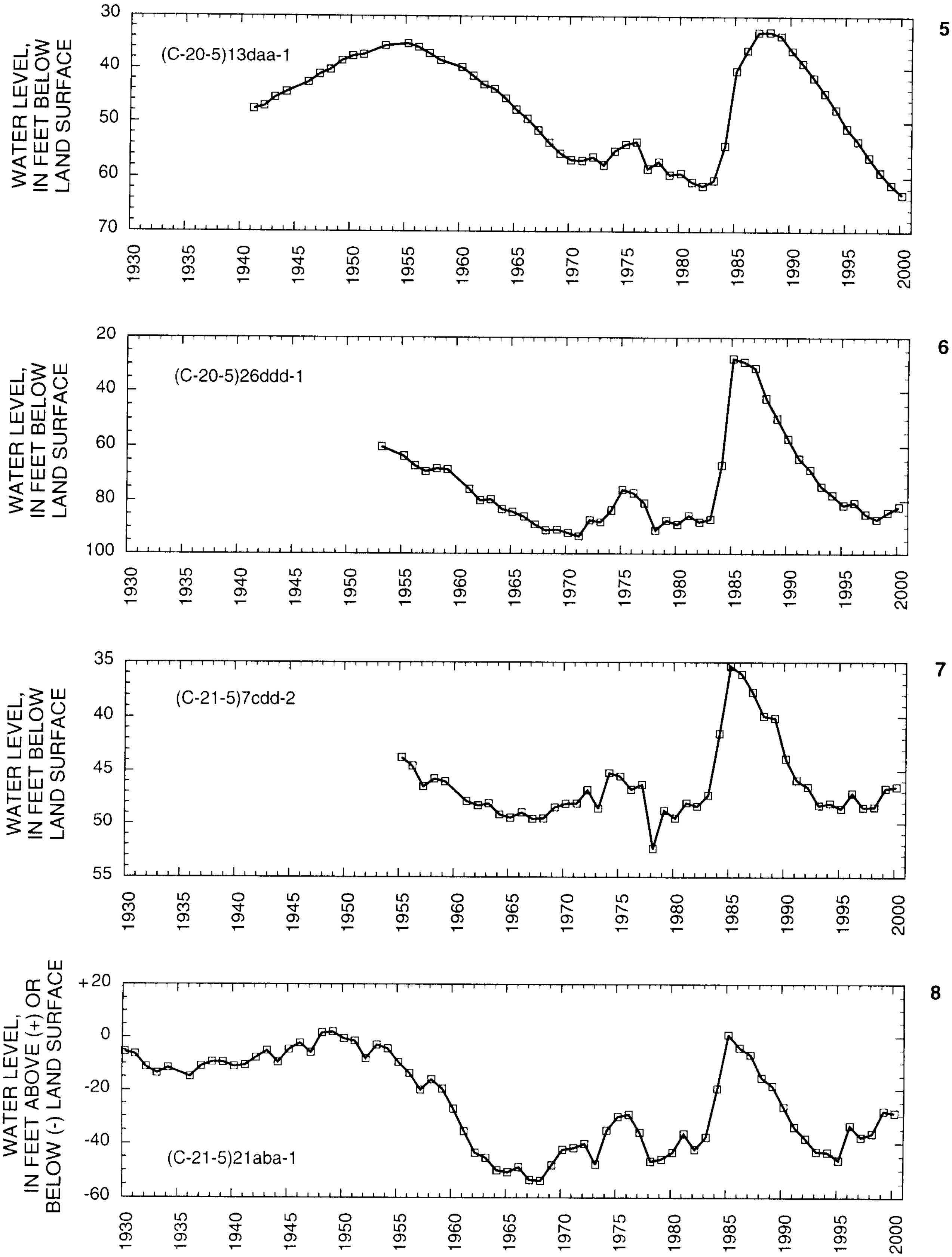


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

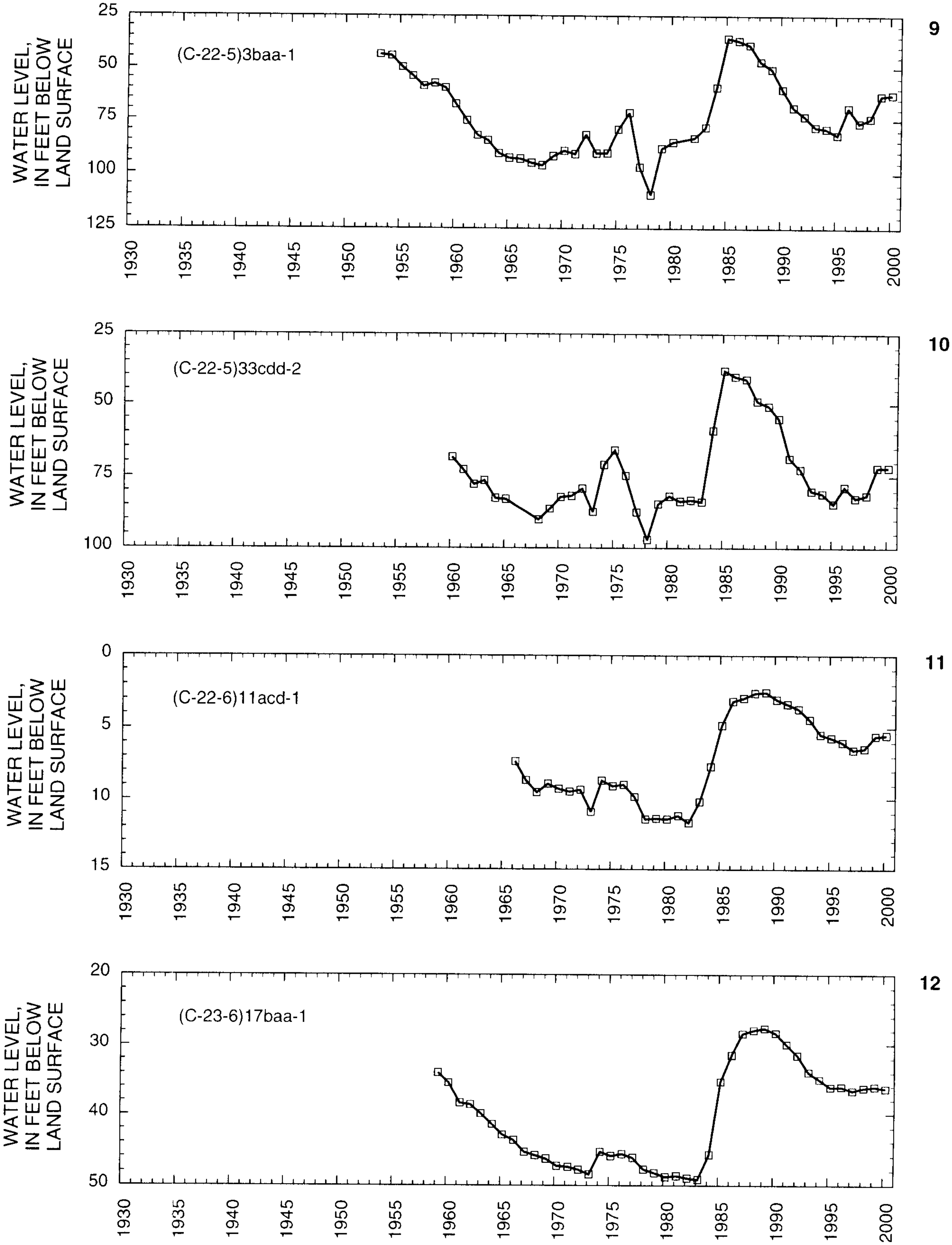


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

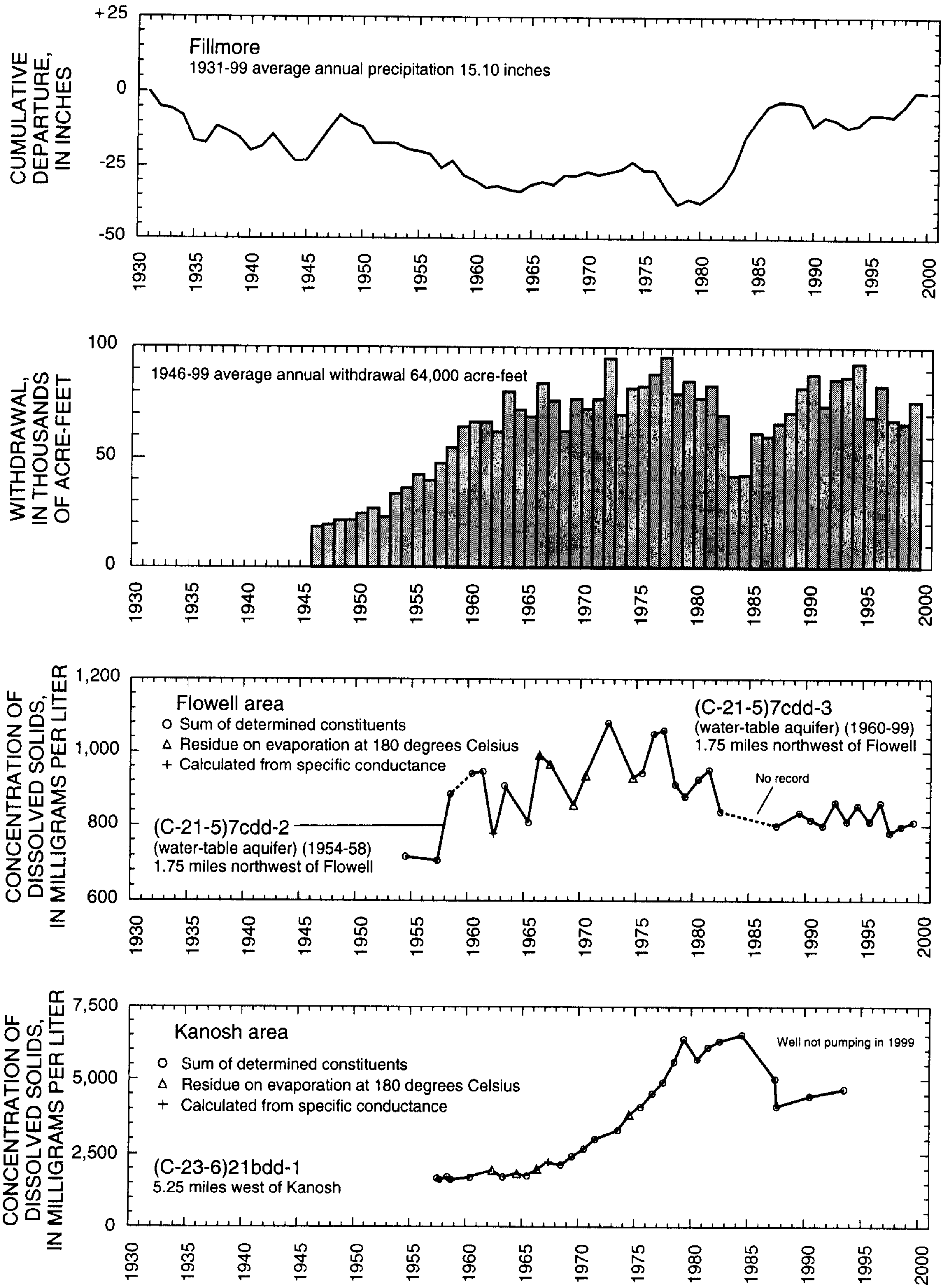


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

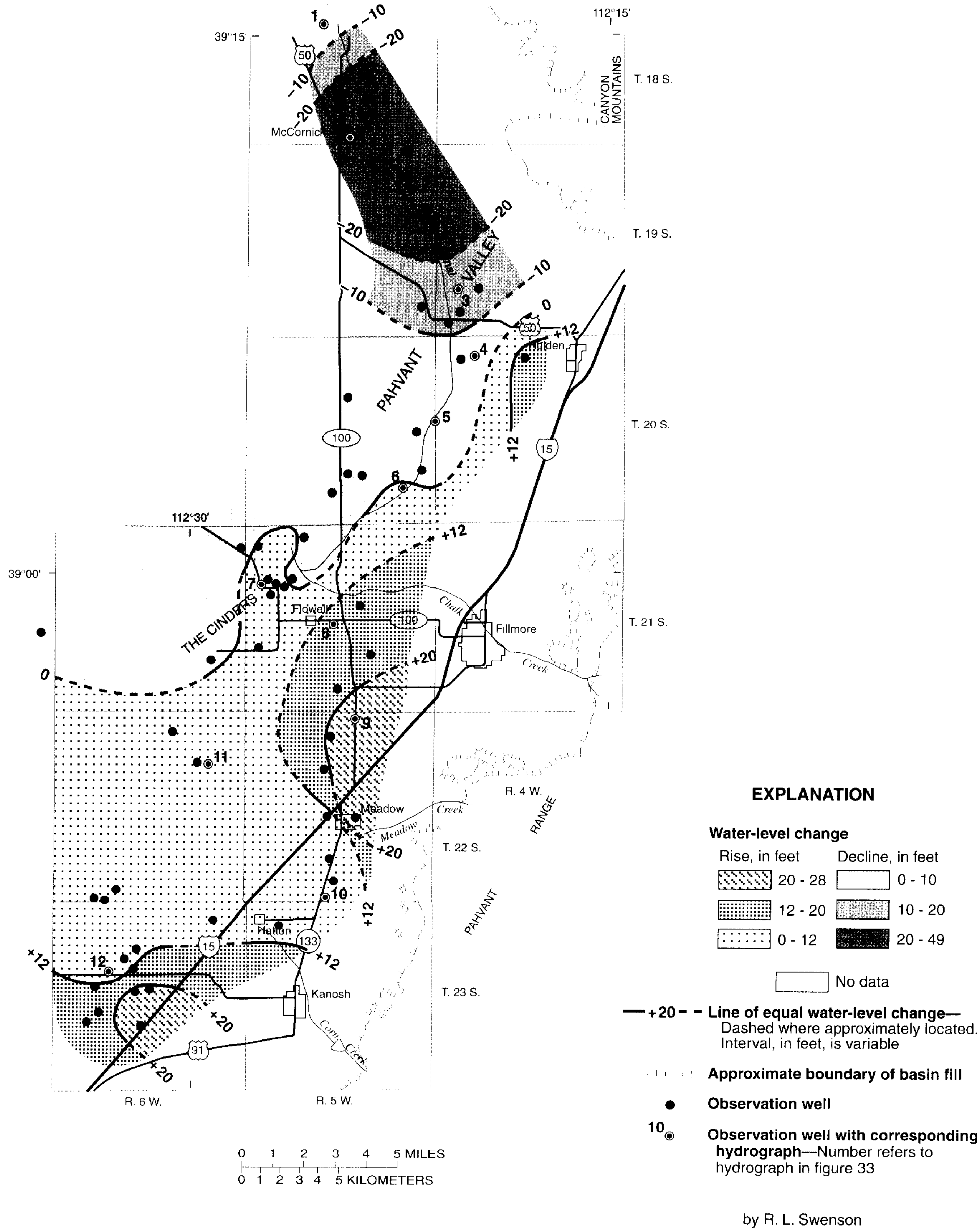


Figure 34. Map of Pahvant Valley showing change of water level from March 1970 to March 2000.

CEDAR VALLEY, IRON COUNTY

By J.H. Howells

Cedar Valley is in eastern Iron County, southwestern Utah. The valley is about 170 square miles in area and is bounded on the east by the Markagunt Plateau, on the west and southwest by Granite Mountain and the Harmony Hills, on the south by a low ground- and surface-water divide near Kanarraville, and on the north by the Black Mountains. Ground water in Cedar Valley occurs in unconsolidated deposits, mostly under water-table conditions. The principal source of recharge to aquifers is water from Coal Creek, which seeps directly from the stream channel into the ground after being diverted for irrigation.

Total estimated withdrawal of water from wells in Cedar Valley in 1999 was about 32,000 acre-feet, which is 4,000 acre-feet less than was reported for 1998 and 1,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of long-term monitoring wells in which the water level was measured during March 2000 is shown in figure 35. The relation of the water level in selected wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 36.

Ground-water levels declined from March 1999 to March 2000 in most of Cedar Valley, in areas for which data are available. The largest decline, about 8 feet, occurred in a long-term monitoring well about 8 miles west of Cedar City. The declines probably resulted from decreased recharge as a result of less-than-average precipitation and streamflow in 1999. Water levels rose in several wells in the northern part of the valley. The largest rise, about 2 feet, occurred in a well about 3 miles northwest of Rush Lake. Rises may have resulted from locally decreased withdrawals.

Ground-water levels declined from March 1970 to March 2000 in most of Cedar Valley, in areas for which data are available (fig. 37). The largest declines, about 21 feet, occurred northwest of Enoch. The decline in water levels probably resulted from increased ground-water withdrawals especially during periods of less-than-average precipitation and streamflow. Rises in water levels occurred near Kanarraville and west of Enoch.

Long-term hydrographs for selected wells in the northern part of Cedar Valley show that March water levels generally declined through 1992 and have risen slightly from 1993-2000. Water levels in the central and southern parts of the valley generally rose in the 1980s and generally have declined since 1989.

Precipitation at Cedar City Federal Aviation Administration Airport in 1999 was 7.06 inches, which is 5.80 inches less than for 1998 and 3.71 inches less than the average annual precipitation for 1951-99. The discharge of Coal Creek was about 22,100 acre-feet in 1999, which is 25,500 acre-feet less than the 47,600 acre-feet for 1998, and 2,200 acre-feet less than the average annual discharge for 1936, 1939-99. The concentrations of dissolved solids in wells (C-35-11)31dbd-1, (C-37-12)23acb-1, and (C-37-12)23abd-1 have ranged between 300 and 600 milligrams per liter.

Water level contours depicting the altitude and configuration of the potentiometric surface in the principal aquifer in Cedar Valley, Iron County, are shown in figure 38.

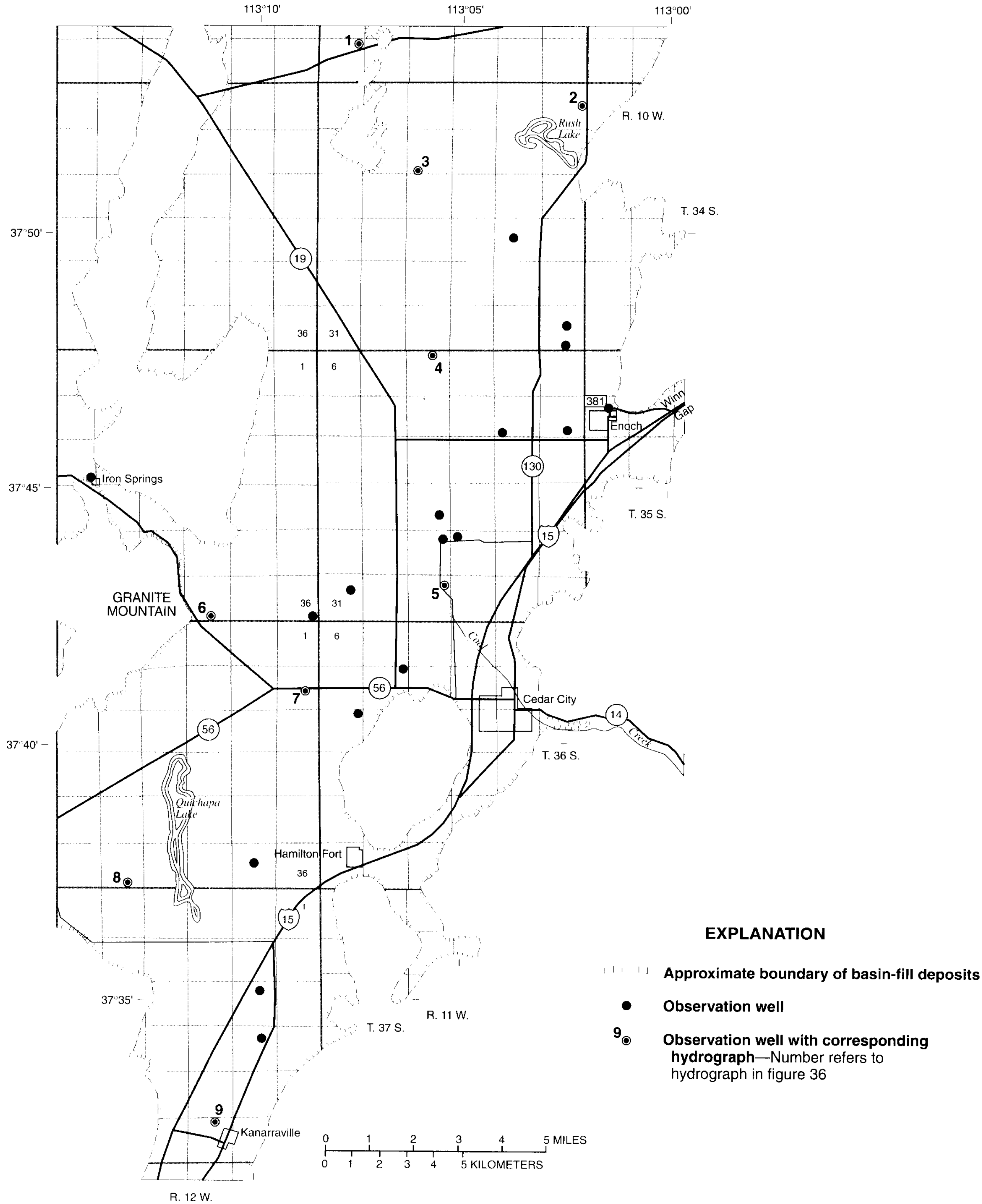


Figure 35. Location of long-term monitoring wells in Cedar Valley, Iron County, in which the water level was measured during March 2000.

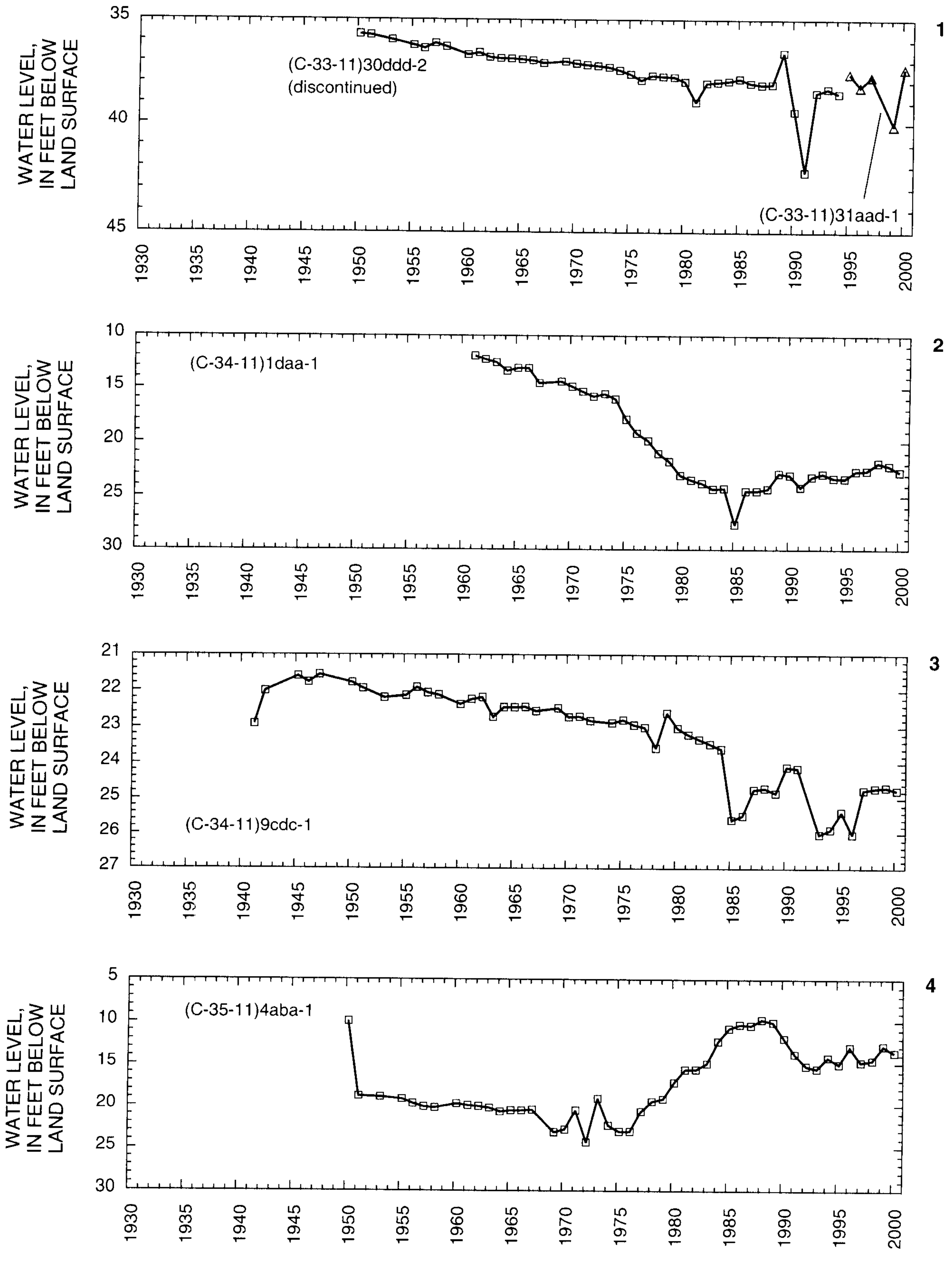


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

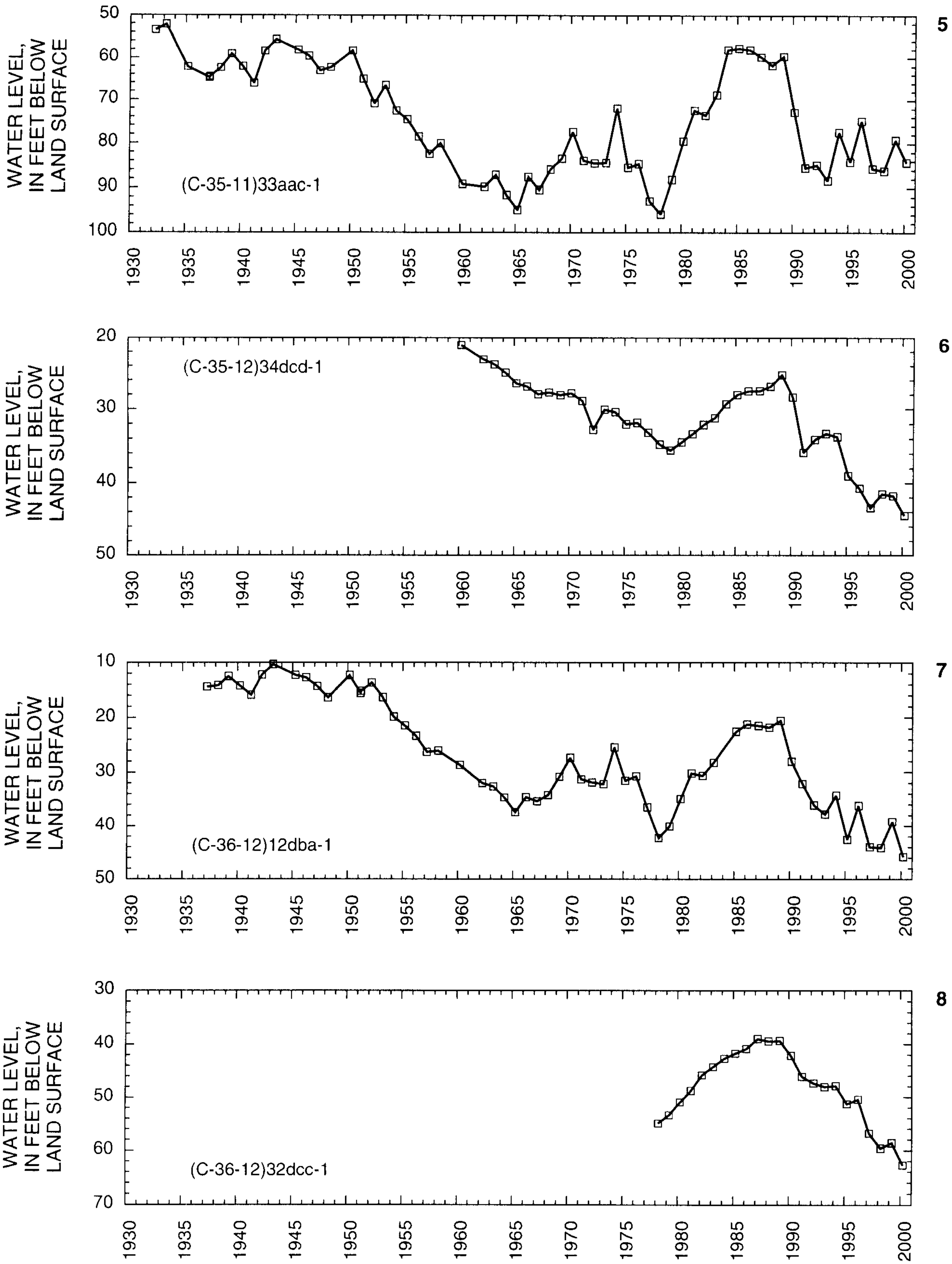


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells–Continued.

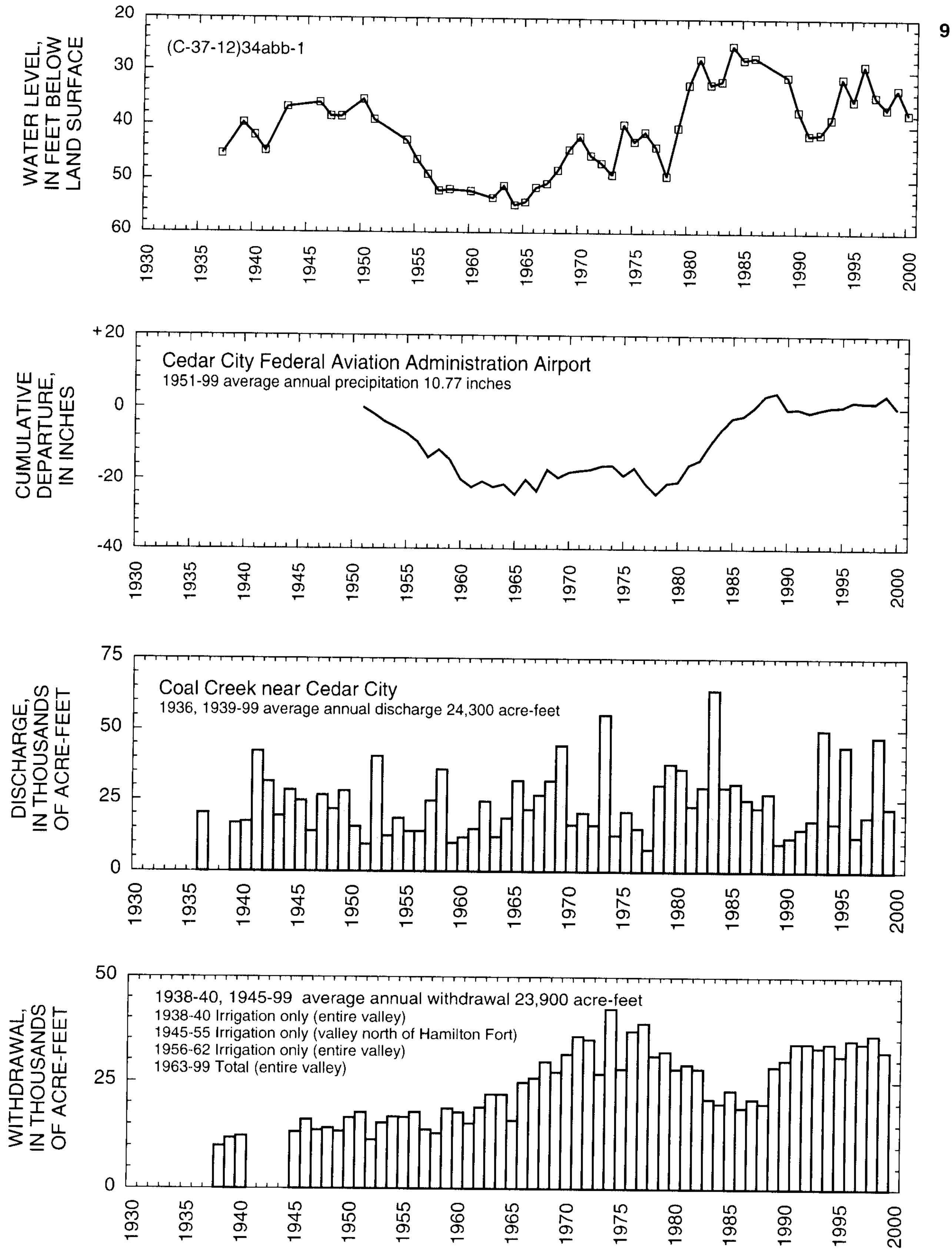


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells–Continued.

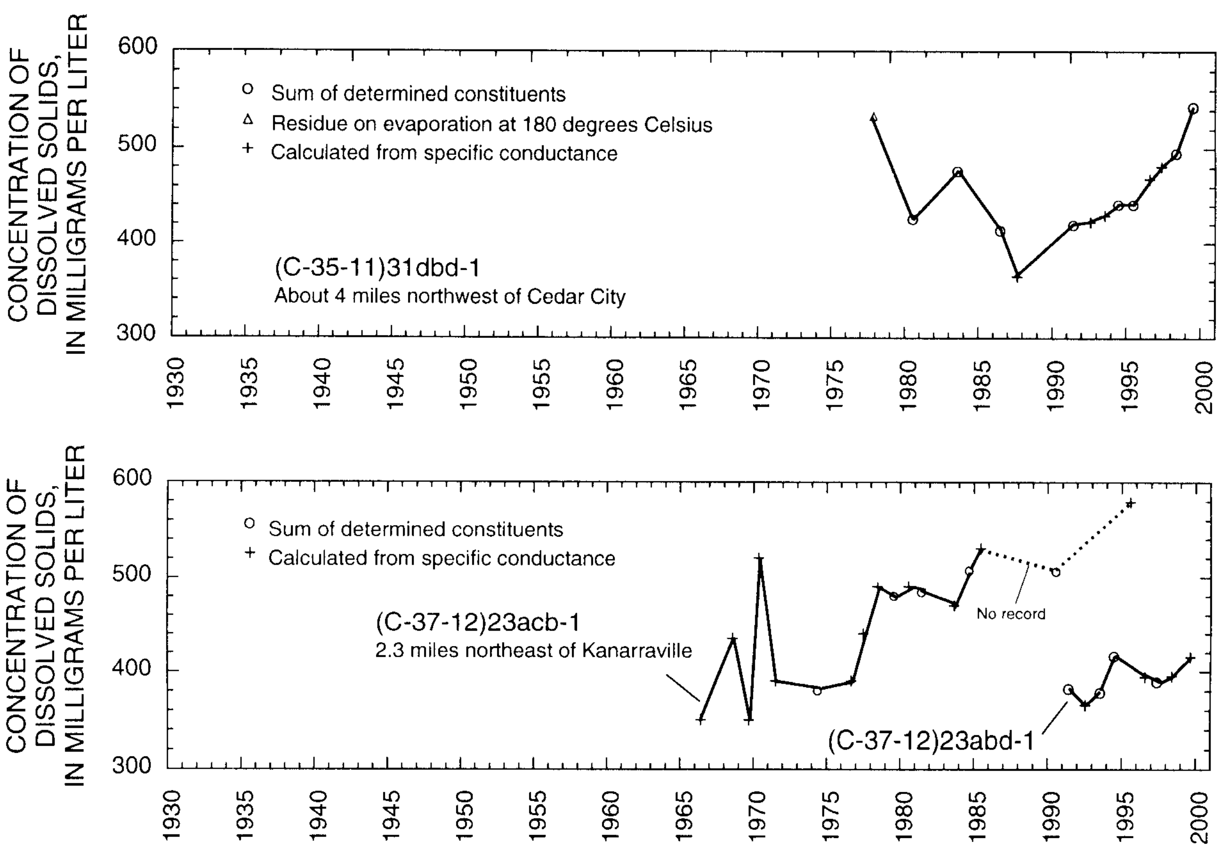


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells–Continued.

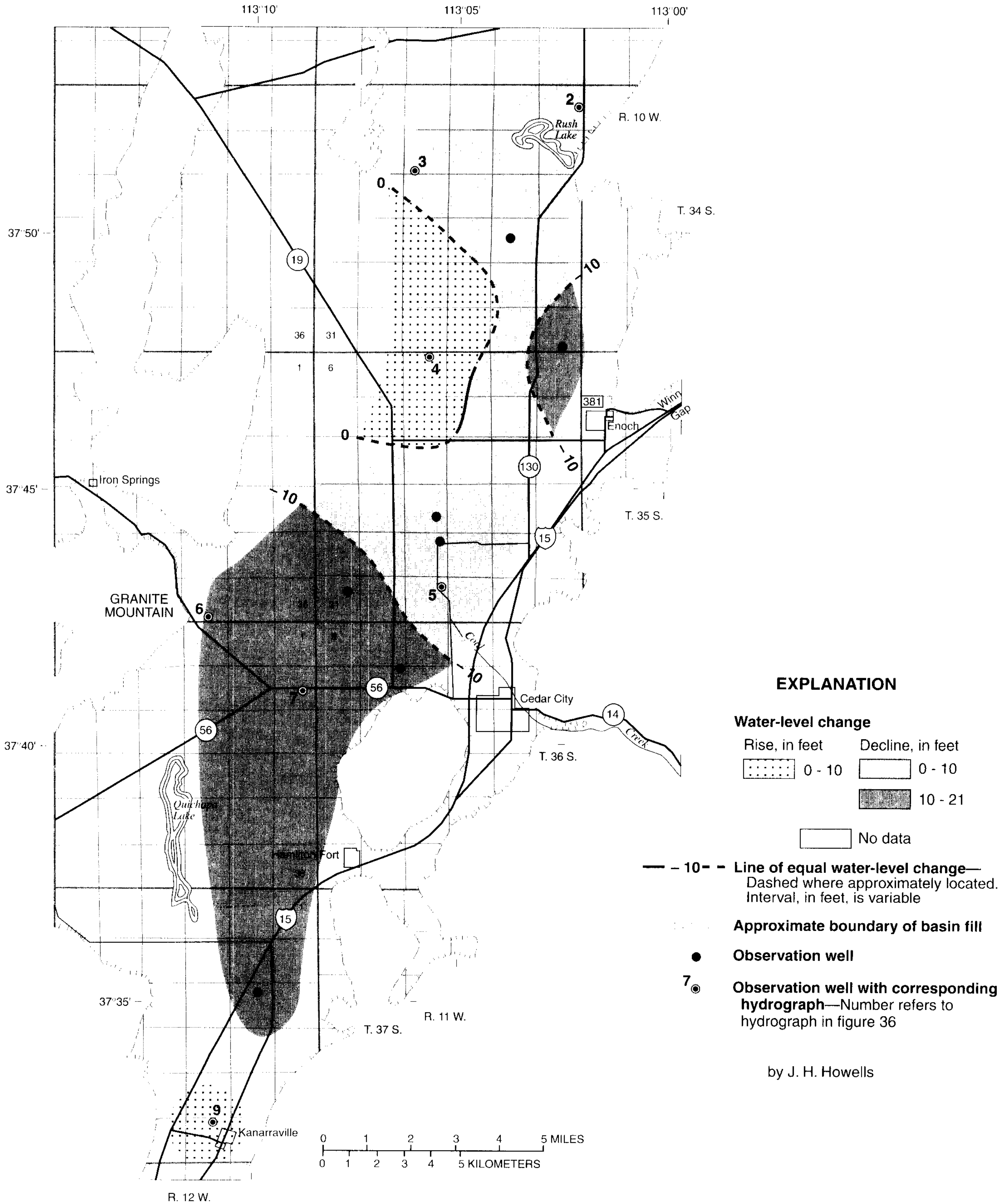


Figure 37. Map of Cedar Valley, Iron County, showing change of water level from March 1970 to March 2000.

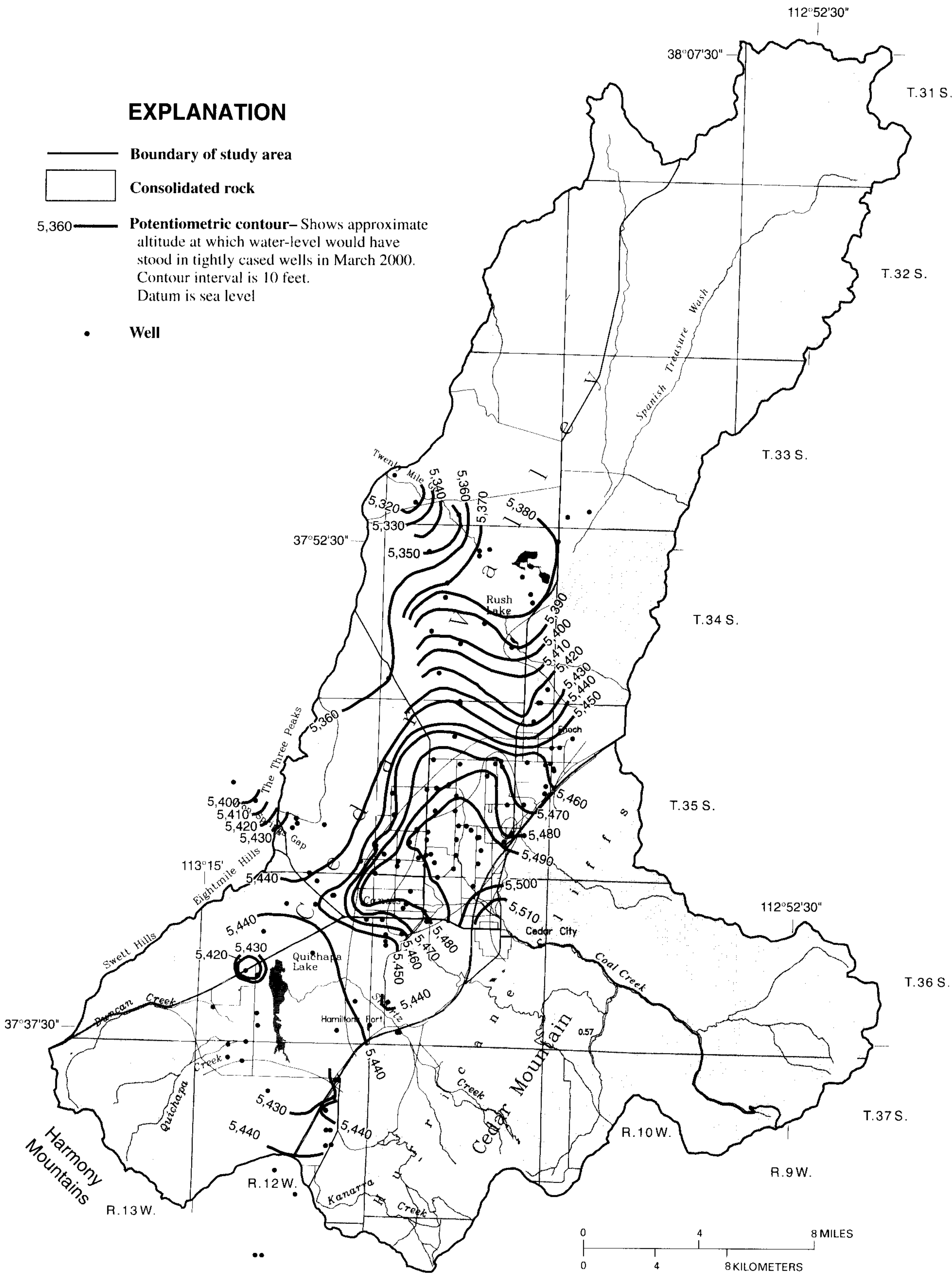


Figure 38. Map of Cedar Valley, Iron County, showing the approximate potentiometric surface, March 2000.

PAROWAN VALLEY

By J.H. Howells

Parowan Valley is in northern Iron County, southwestern Utah. The valley is about 160 square miles in area and is bounded on the east and south by the Markagunt Plateau, on the west by the Red Hills, and on the north by the Black Mountains. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in Parowan Valley in 1999 was about 33,000 acre-feet, which is about 5,000 acre-feet more than was reported in 1998 and 4,000 acre-feet more than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells in Parowan Valley in which the water level was measured during March 2000 is shown in figure 39. The relation of the water level in selected wells to cumulative departure from the average annual precipitation at Parowan Power Plant, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1 is shown in figure 40.

Water levels rose from March 1999 to March 2000 in the central part of Parowan Valley and in two wells in the southern part of the valley. The largest rise, about 6 feet, occurred in a well northeast of Summit and probably resulted from decreased local withdrawals for irrigation. Water levels declined in the rest of the valley for which data are available. The largest declines, about 4 feet, occurred in two wells about 2 miles north of Summit. Declines probably resulted from increased local withdrawals for irrigation and from less-than-average precipitation in 1999.

Water levels declined from March 1970 to March 2000 in all parts of Parowan Valley for which data are available (fig. 41). The largest decline, about 37 feet, occurred southwest of Paragonah. The decline in water levels probably is the result of increased withdrawals for irrigation. Prior to 1970, annual withdrawals ranged from 7,000 to 22,000 acre-feet. Since 1970, withdrawals have ranged from 20,000 to 36,000 acre-feet.

Water levels in Parowan Valley generally have declined since 1950, although rises have occurred during 1973-74, 1983-85, and 1996-99. The rises are probably the result of greater-than-average precipitation during those periods.

Precipitation at Parowan Power Plant in 1999 was 7.09 inches, which is 5.45 inches less than the average annual precipitation for 1935-99 and 10.44 inches less than in 1998. The concentration of dissolved solids in water from well (C-33-8)31ccc-1 has shown little change since 1976 (fig. 40).

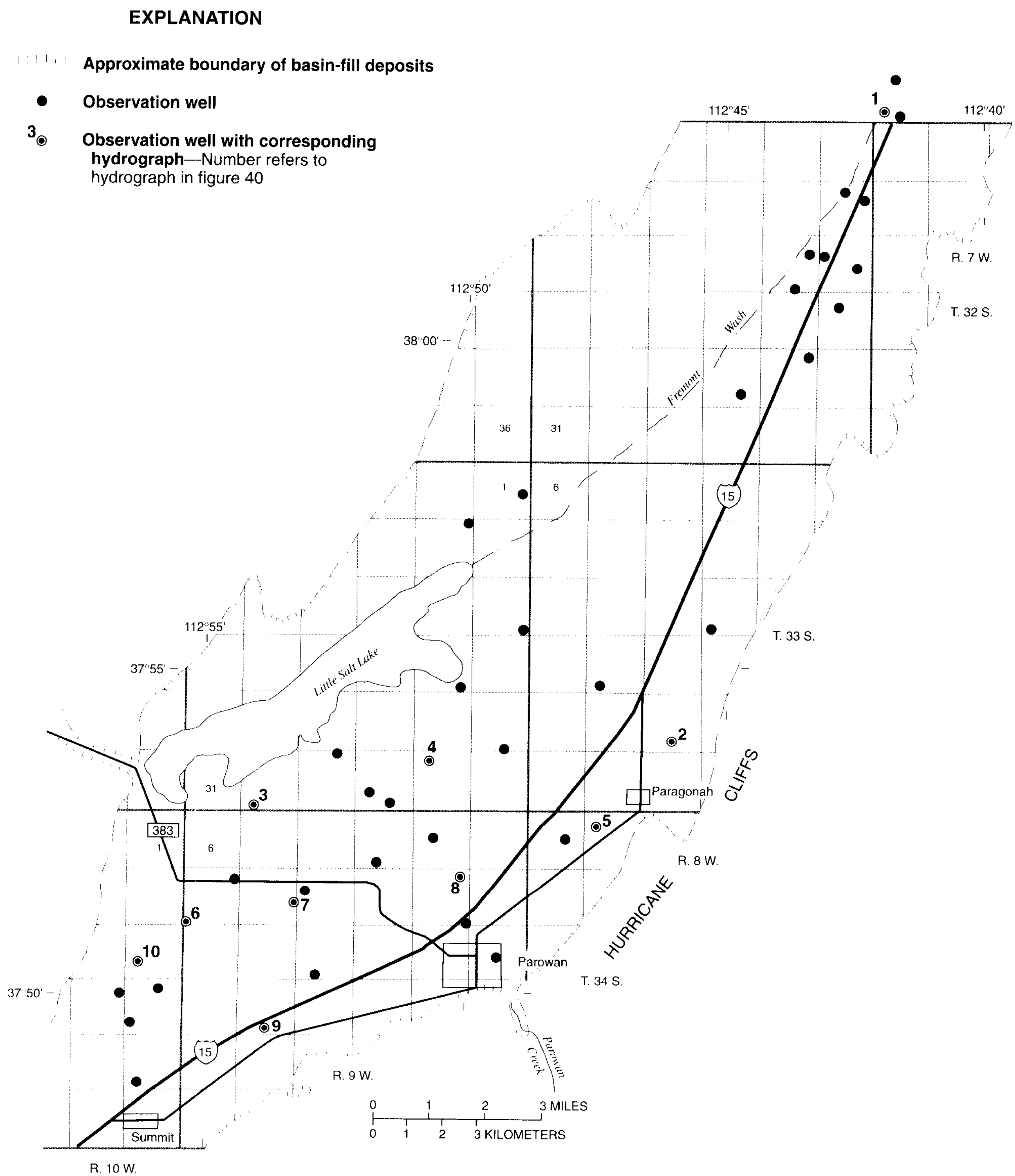


Figure 39. Location of wells in Parowan Valley in which the water level was measured during March 2000.

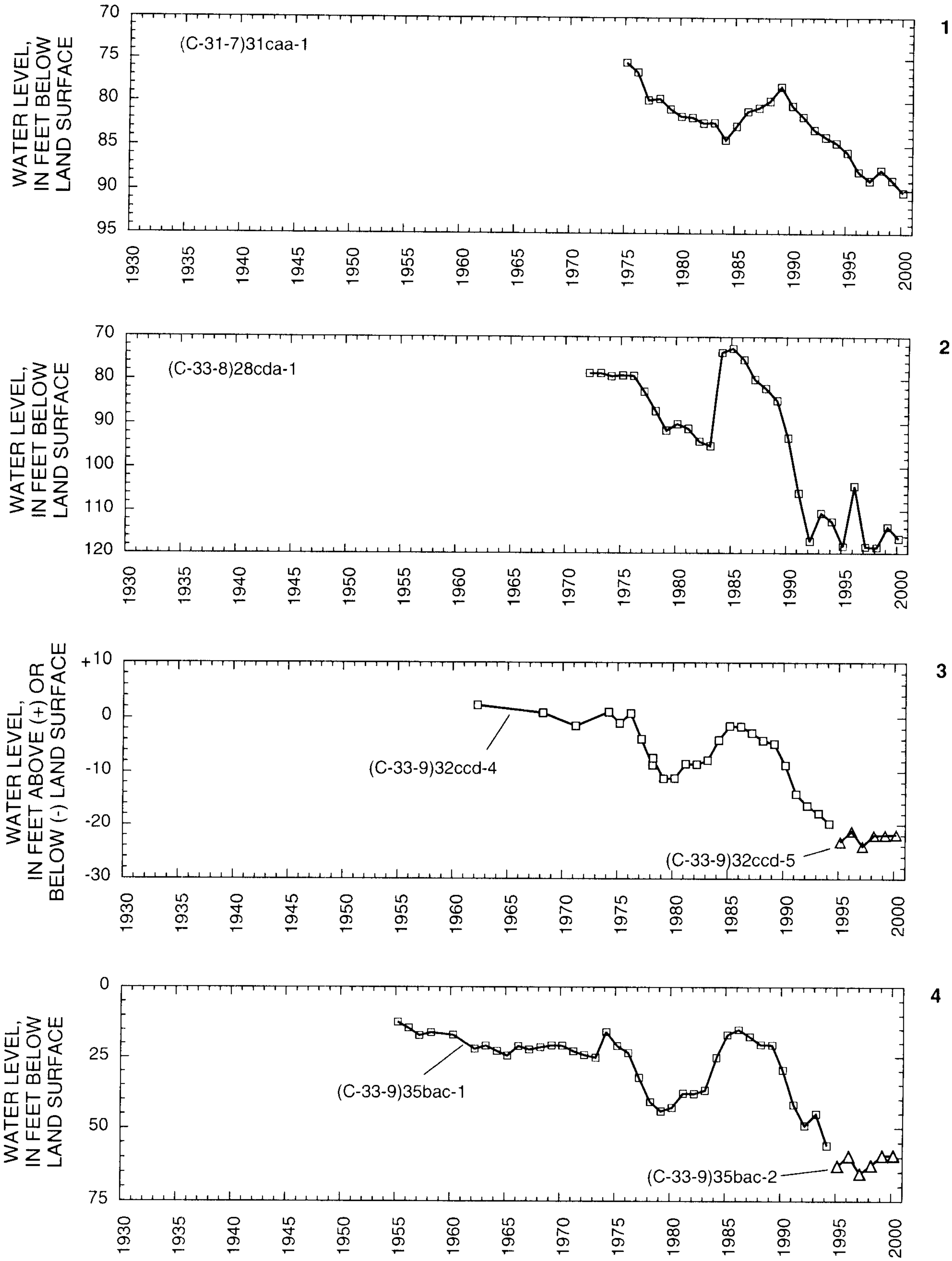


Figure 40. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Parowan Power Plant, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.

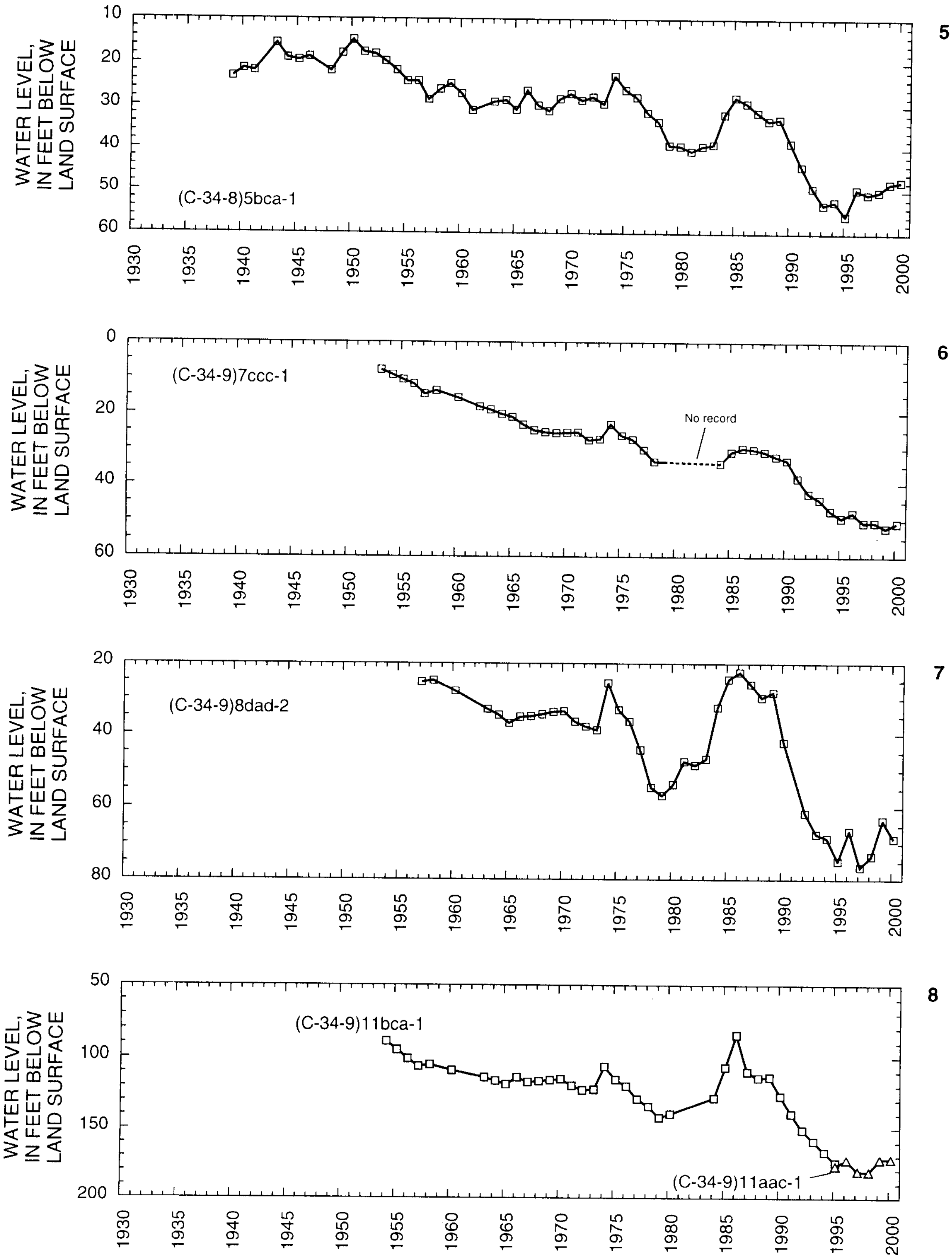
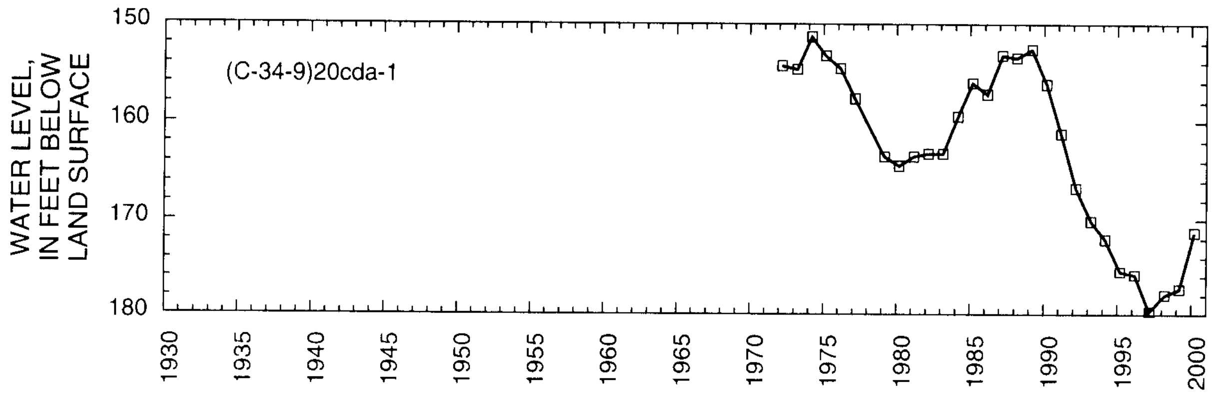


Figure 40. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Parowan Power Plant, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.



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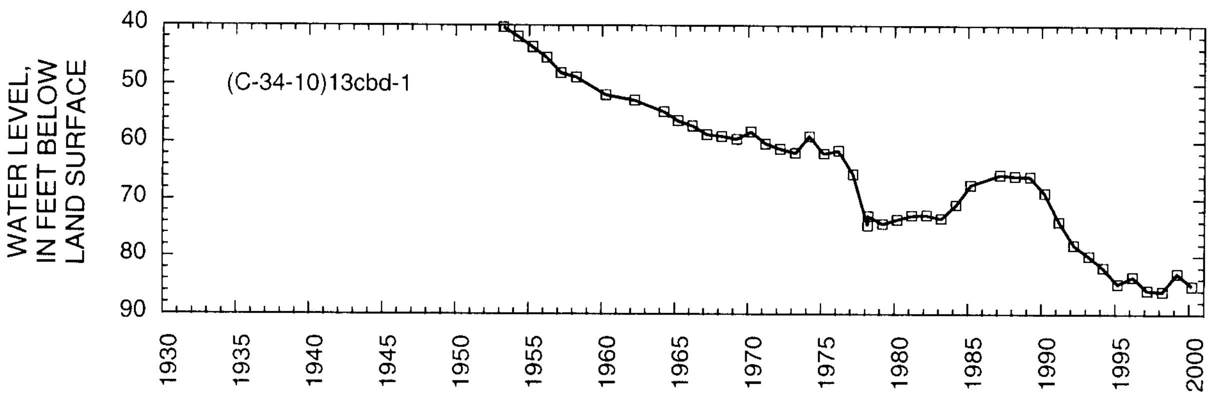

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Figure 40. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Parowan Power Plant, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

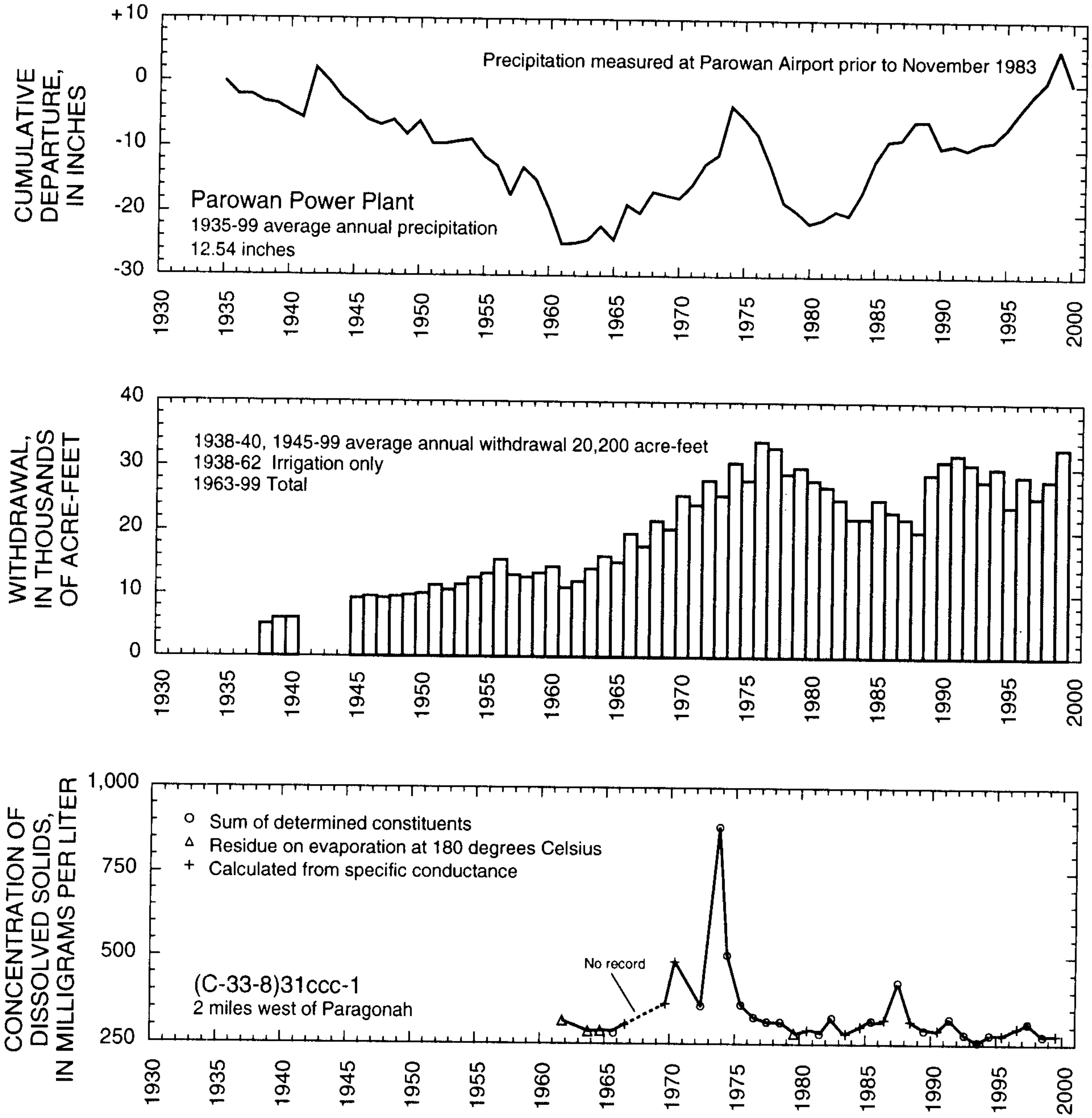


Figure 40. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Parowan Power Plant, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

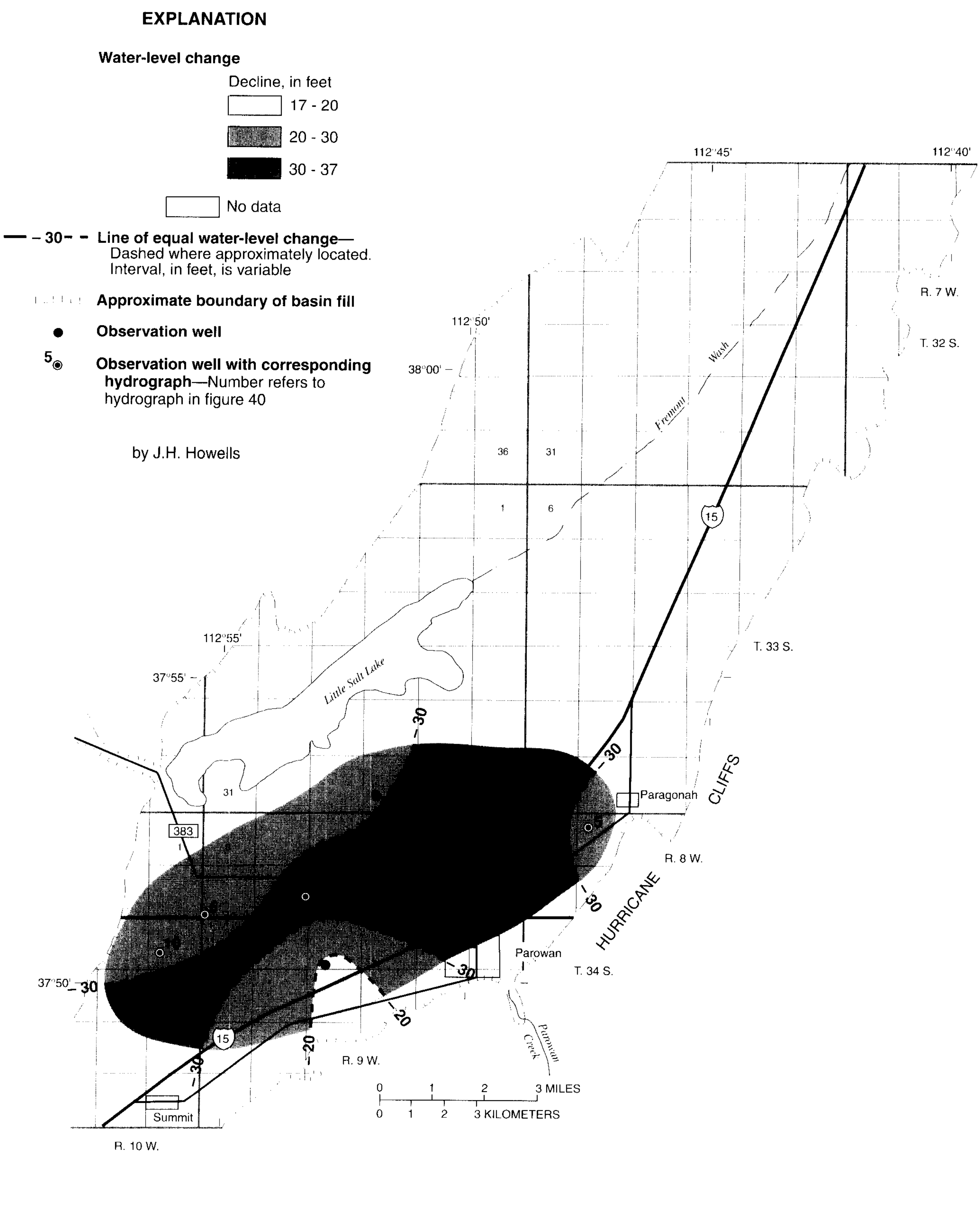


Figure 41. Map of Parowan Valley showing change of water level from March 1970 to March 2000.

ESCALANTE VALLEY

Milford Area

By B.A. Slaugh

The Milford area is in southwest Utah in parts of Millard, Beaver, and Iron Counties. It is bounded by the Cricket Mountains on the north, the Black Mountains on the south, the Mineral Mountains on the east, and the San Francisco Mountains and part of the Wah Wah Mountains on the west.

Total estimated withdrawal of water from wells in the Milford area of the Escalante Valley in 1999 was about 41,000 acre-feet, which is the same amount that was reported for 1998 and 8,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells measured during March 2000 is shown in figure 42. The relation of water levels in selected wells to cumulative departure from the average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11) 25dcd-1 is shown in figure 43.

Long-term hydrographs for selected wells in the Milford area show that water levels generally have declined since the early 1950s in the south-central Milford area in response to long-term increased withdrawal. Water-level rises during 1983-85 resulted from greater-than-average precipitation during 1982-85 and increased recharge from record flow in the Beaver River during 1983-84. Water levels from March 1999 to March 2000 generally declined in the outer areas of the valley as a result of less-than-average precipitation. Rises occurred in the central areas of the valley because of the increased use of surface water. Precipitation at Black Rock in 1999 was 6.24 inches, 7.17 inches less than in 1998 and 2.81 inches less than the 1952-99 average annual precipitation.

Water levels generally declined in most of the Milford area from March 1970 to March 2000 (fig. 44). The greatest decline, about 20 feet, occurred in an area south of Milford. Declines in water levels resulted from continued large ground-water withdrawals for irrigation. Rises in water levels of almost 6 feet occurred north of Minersville.

Discharge of the Beaver River in 1999 was about 50,900 acre-feet, which is 21,600 acre-feet more than the 1931-35, 1938-99 average annual discharge. From 1950 to 1983, the concentration of dissolved solids in water from well (C-28-11) 25dcd-1 increased from about 500 to almost 2,000 milligrams per liter. Since 1983, concentrations have decreased to about 700 milligrams per liter in 1999.

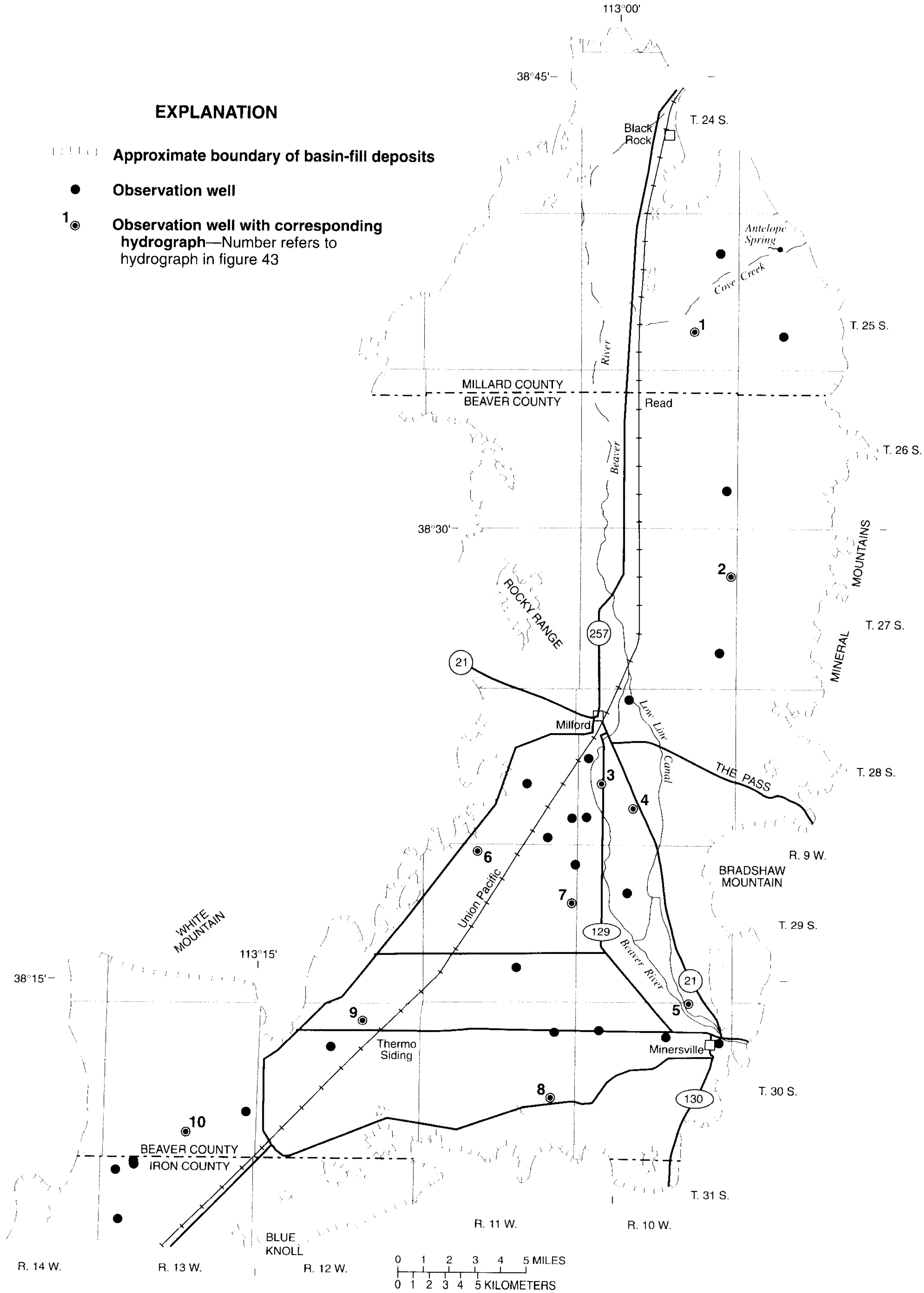


Figure 42. Location of wells in the Milford area in which the water level was measured during March 2000.

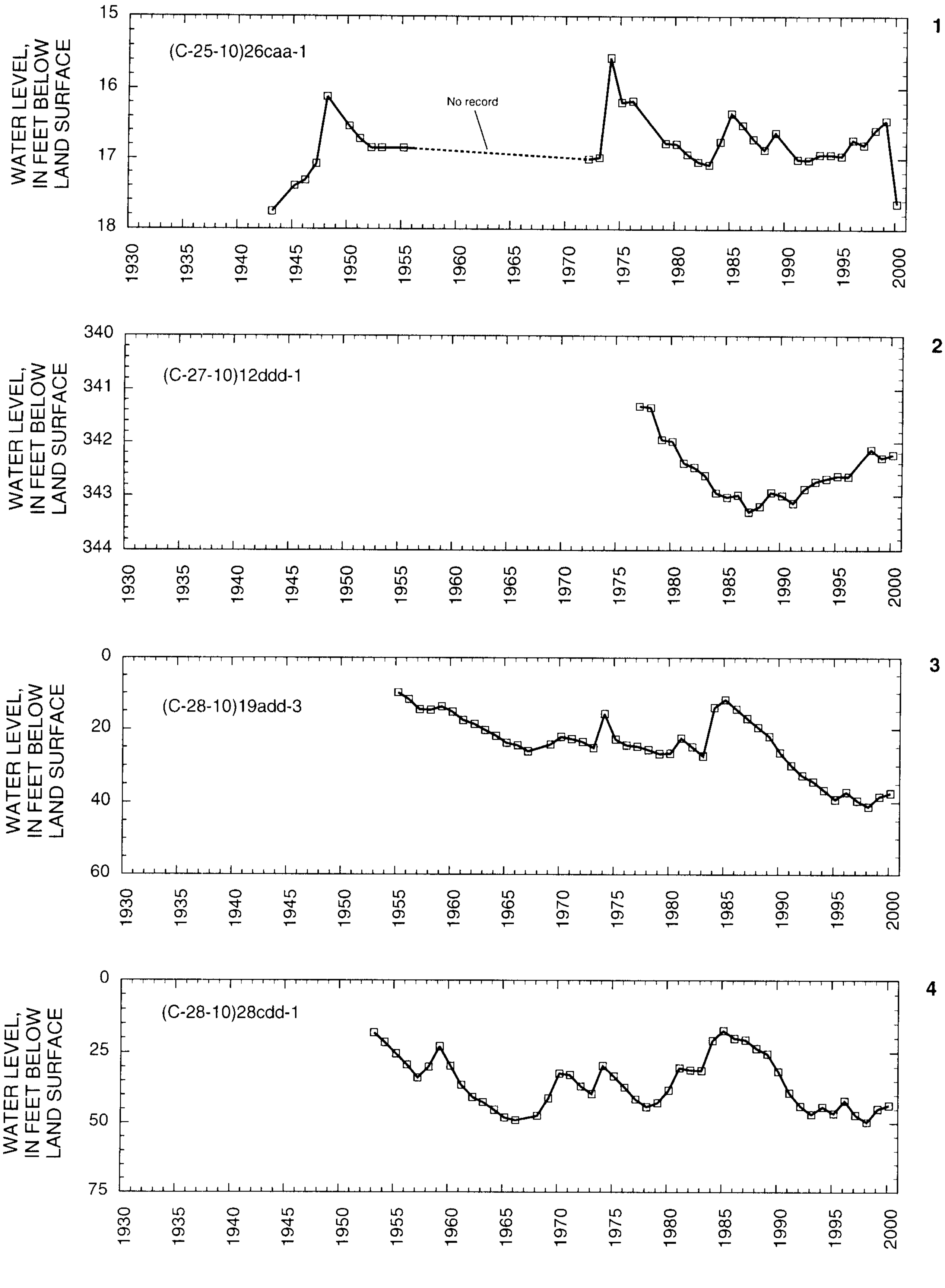
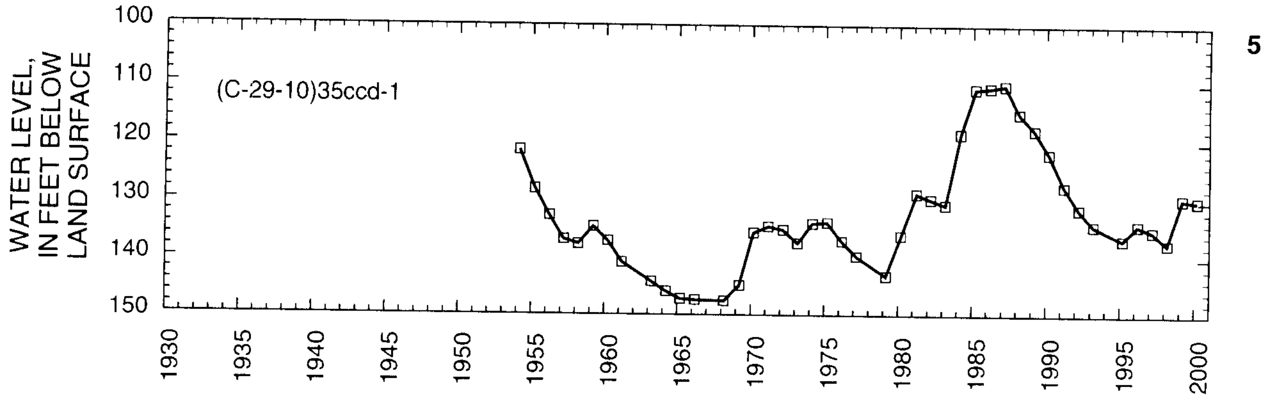
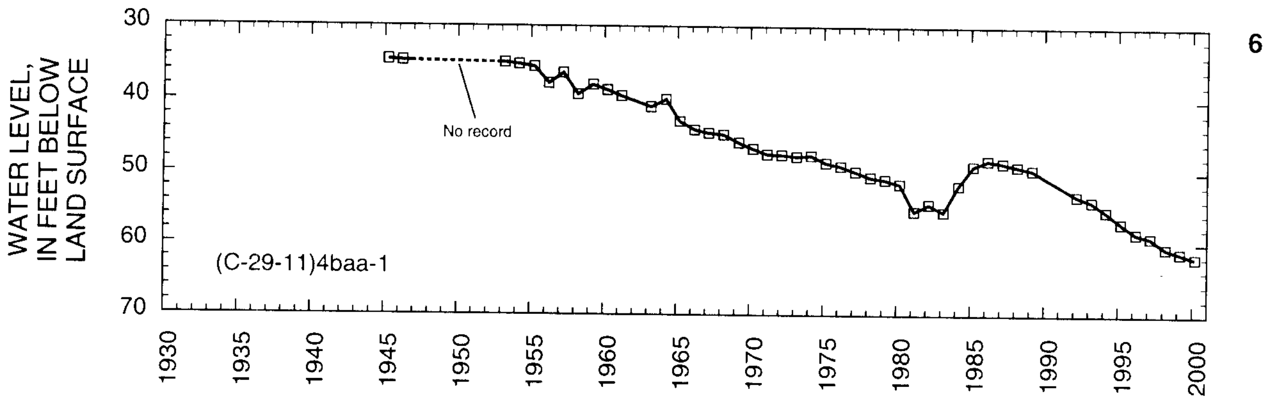
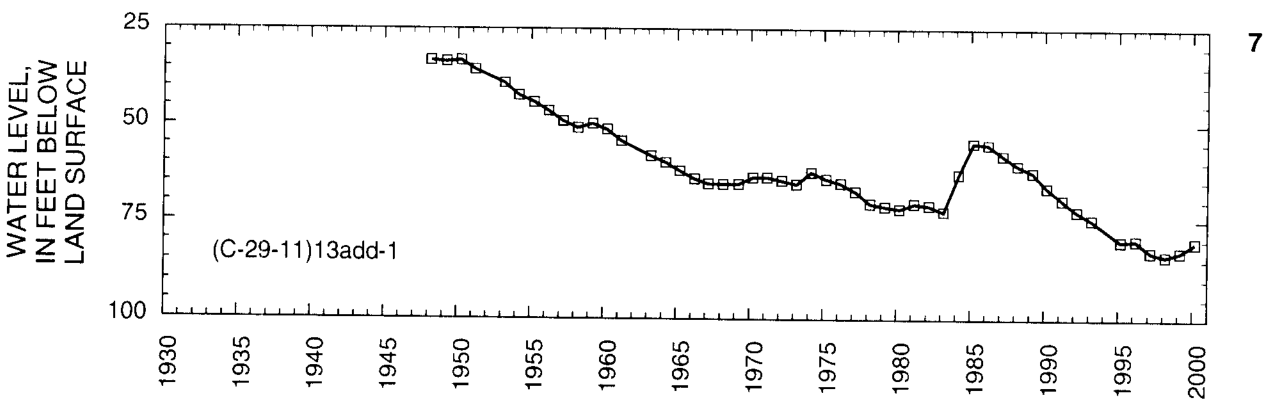


Figure 43. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1.







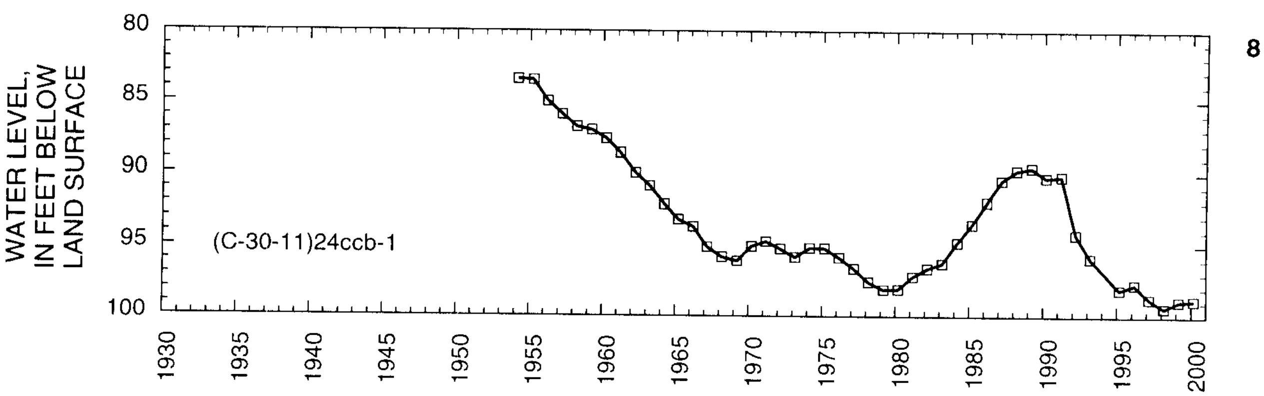
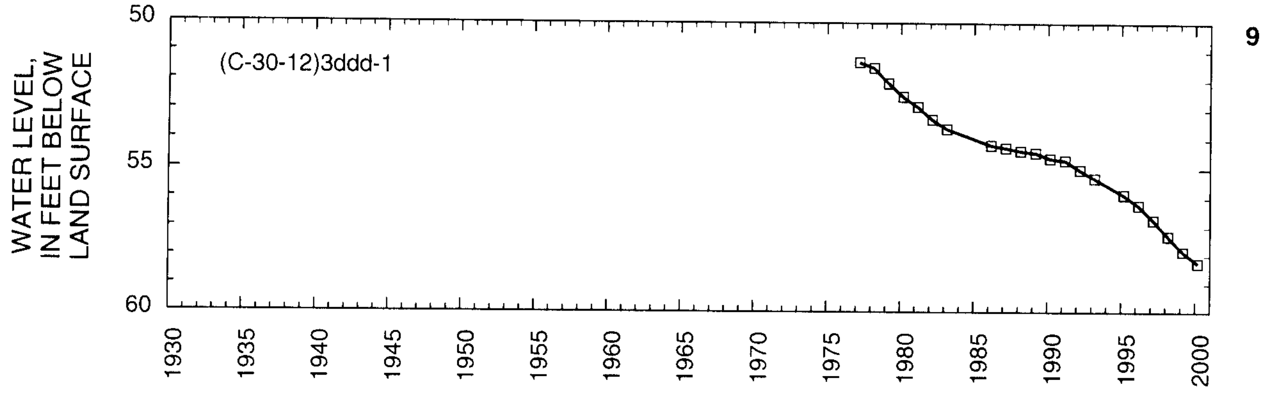


Figure 43. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.



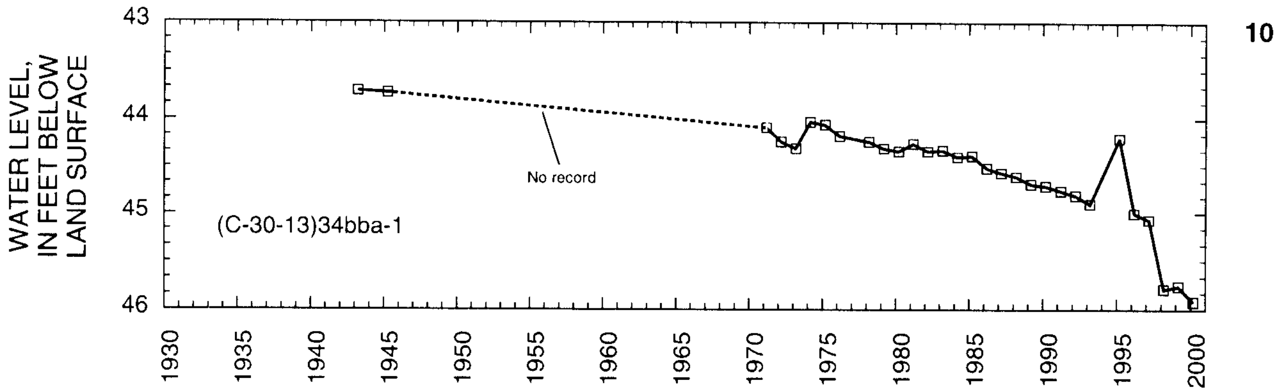


Figure 43. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.

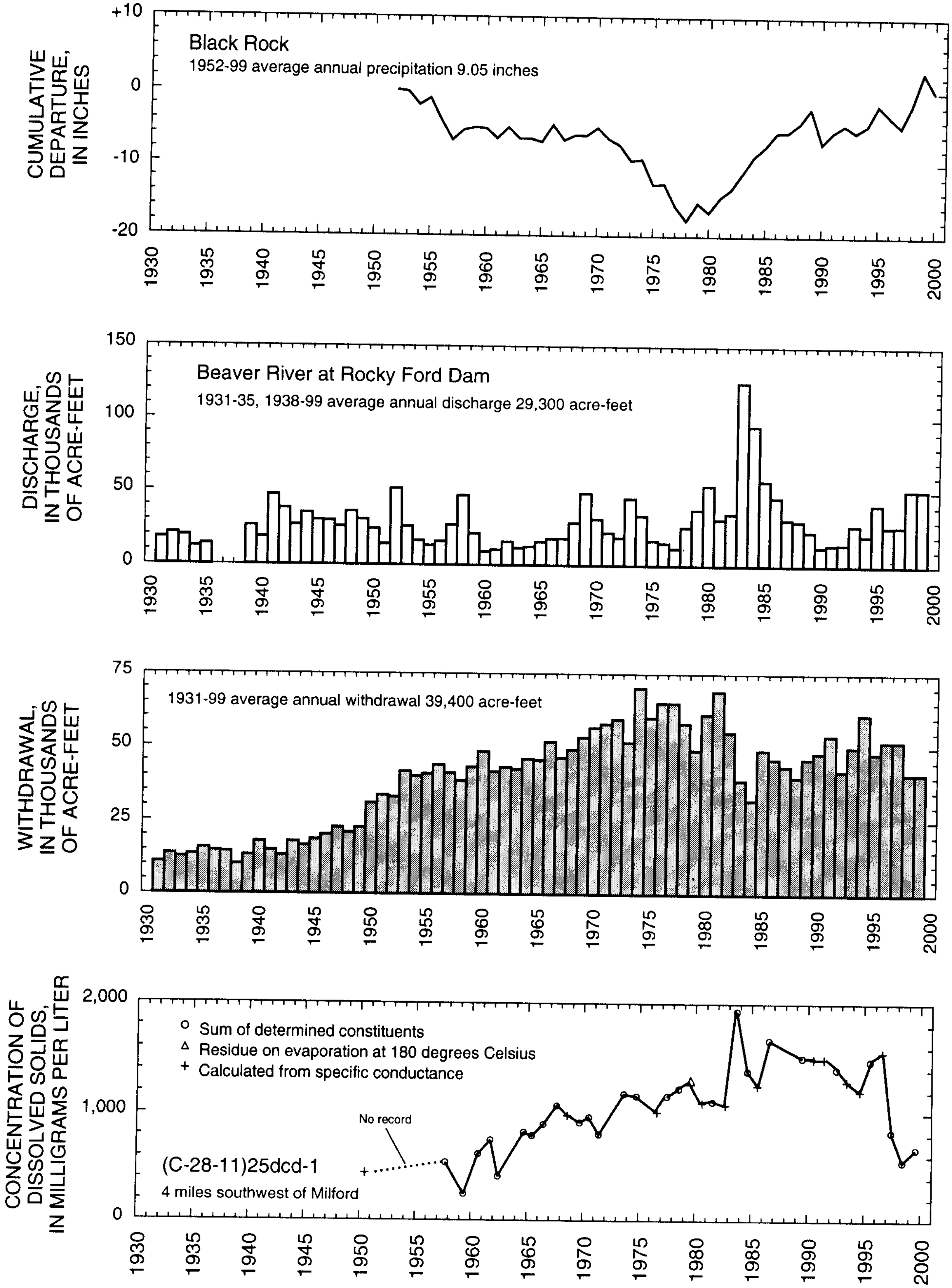


Figure 43. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.

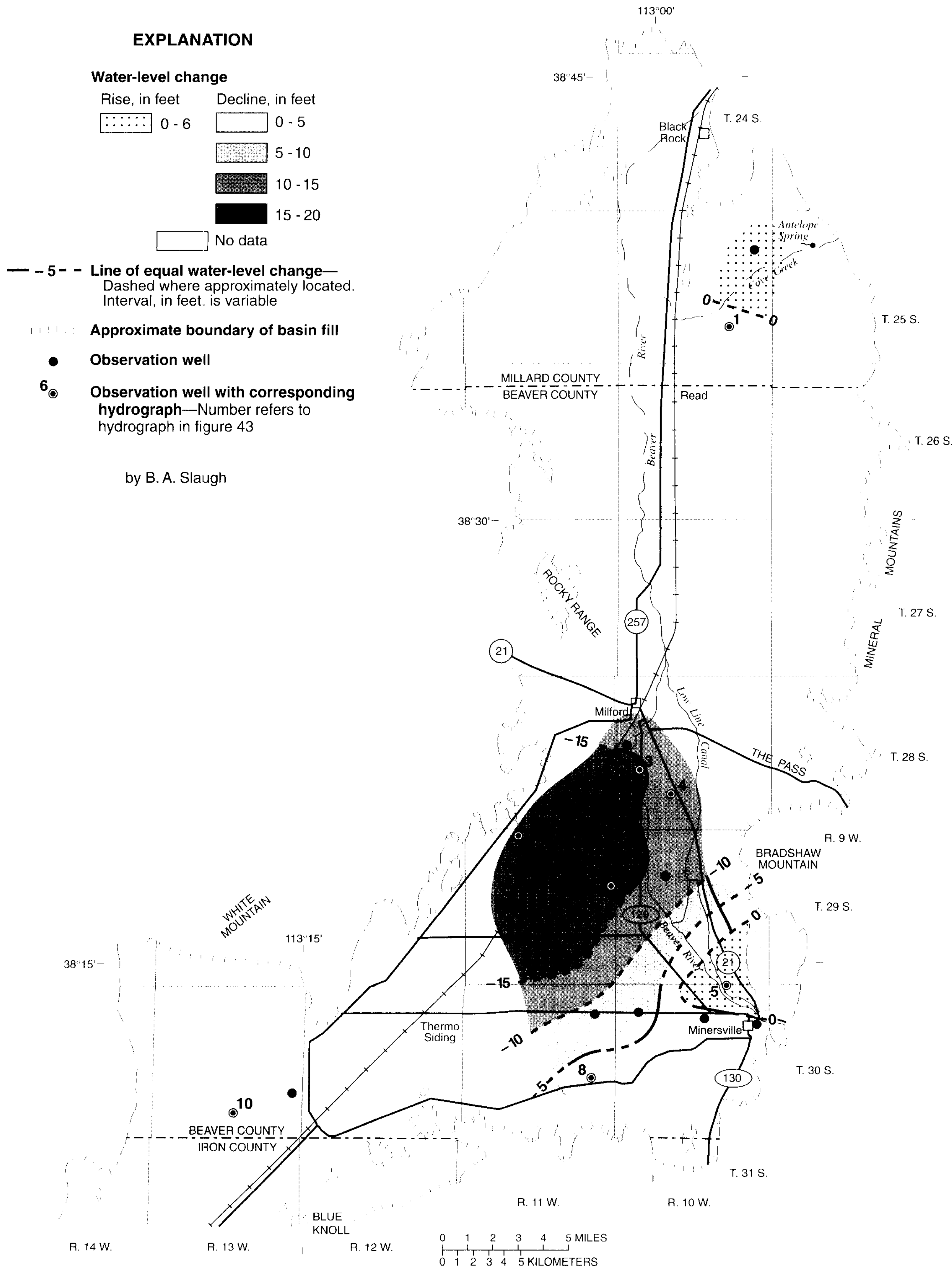


Figure 44. Map of the Milford area showing change of water level from March 1970 to March 2000.

ESCALANTE VALLEY

Beryl-Enterprise Area

By H.K. Christiansen

The Beryl-Enterprise area includes about 400 square miles in the southern end of Escalante Valley. It is bounded by Mud Springs Hills, Bald Hills, and Three Peaks to the east, the Antelope Range and Shoal Creek to the south, and the Wah Wah Mountains and Indian Peak Range to the north and west.

Total estimated withdrawal of water from wells in the Beryl-Enterprise area in 1999 was about 79,000 acre-feet, which is 5,000 acre-feet more than in 1998 and 1,000 acre-feet less than the average annual withdrawal for 1989-98 (tables 2 and 3).

The location of wells in which the water level was measured during March 2000 is shown in figure 45. The relation of the water level in selected wells to cumulative departure from average annual precipitation at Modena, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2 is shown in figure 46. Water levels generally declined from March 1999 to March 2000 in the Beryl-Enterprise area. Declines were probably a result of less-than-average precipitation in 1999.

Long-term hydrographs for selected wells in the Beryl-Enterprise area show a general decline in water levels throughout the valley since 1950. The declines are a result of continued large withdrawal for irrigation since 1950. A decline of about 95 feet since 1948 occurred in well (C-36-16)29daa-1, about 5 miles northeast of Enterprise.

Water levels declined from March 1970 to March 2000 in most of the Beryl-Enterprise area. Declines of as much as 52 feet occurred in the area around Beryl Junction and Newcastle (fig. 47). The declines are the result of continued large withdrawals for irrigation. Water-level rises of about 2 feet occurred in an area southwest of Enterprise along Shoal and Pine Creeks.

Precipitation at Modena in 1999 was 6.82 inches, which is 3.58 inches less than the average annual precipitation for 1936-99 and 8.32 inches less than in 1998. Concentration of dissolved solids in water from well (C-34-16)28dcc-2 has increased from about 460 milligrams per liter in 1967 to about 650 milligrams per liter in 1999.

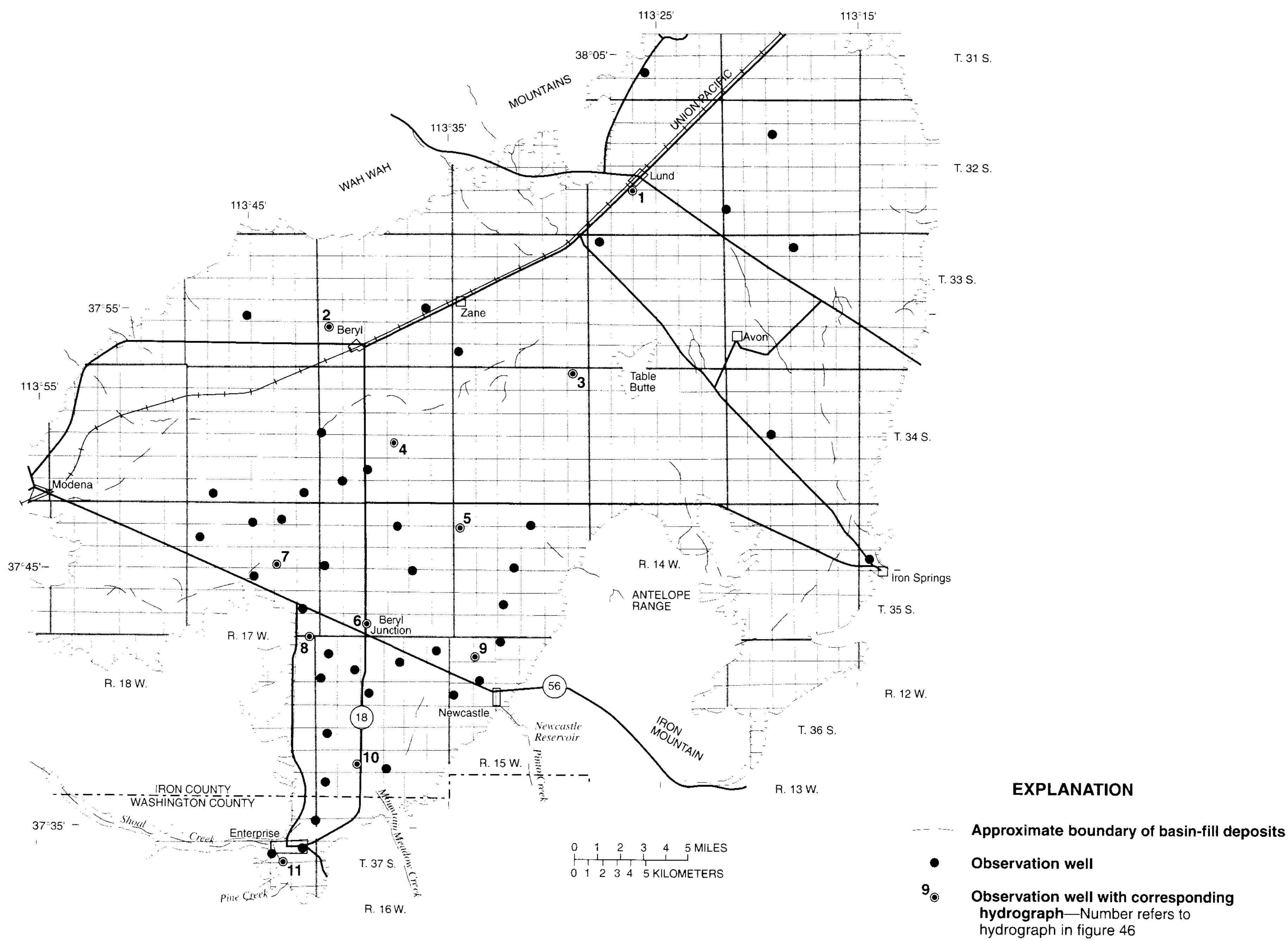


Figure 45. Location of wells in the Beryl-Enterprise area in which the water level was measured during March 2000.

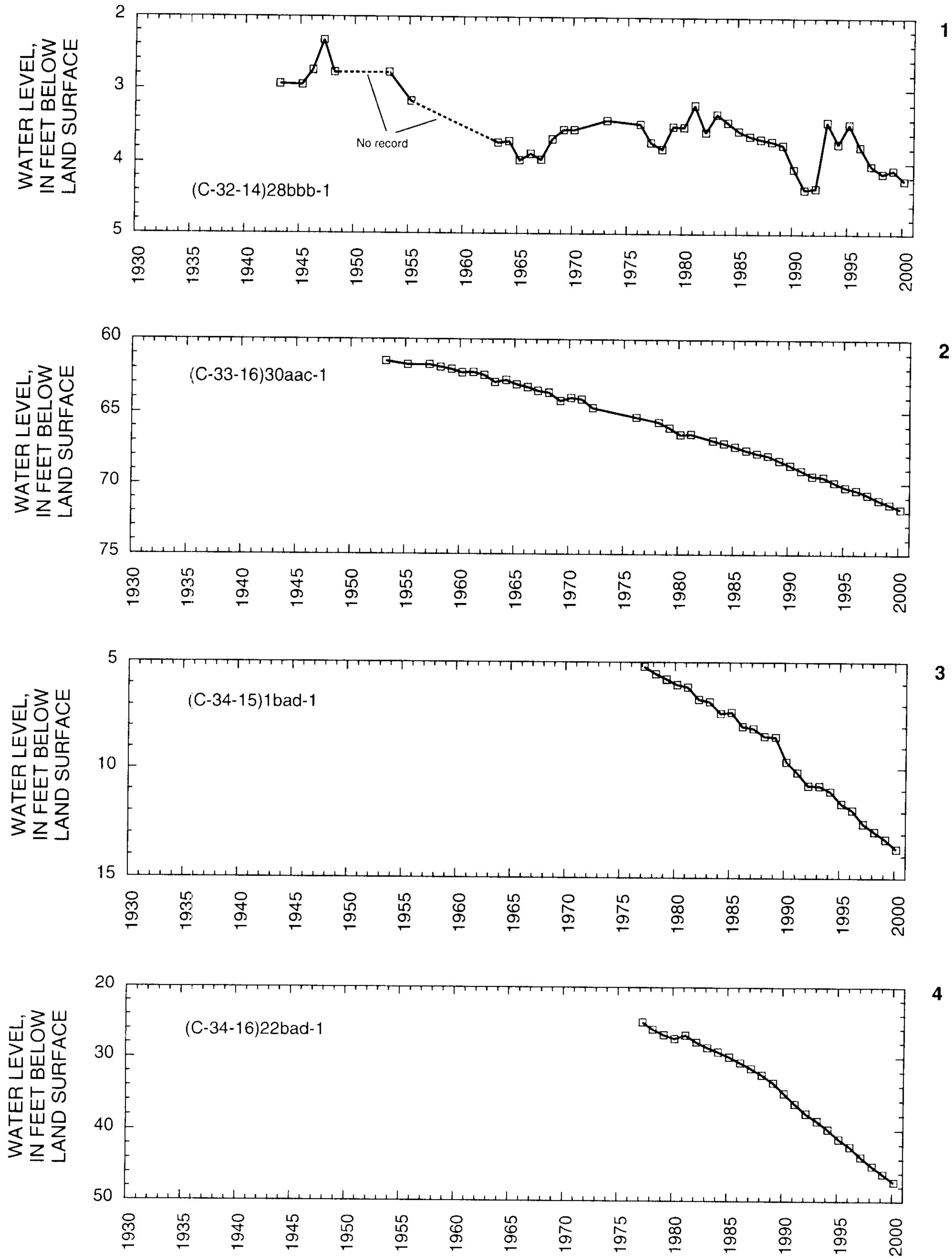


Figure 46. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Modena, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2.

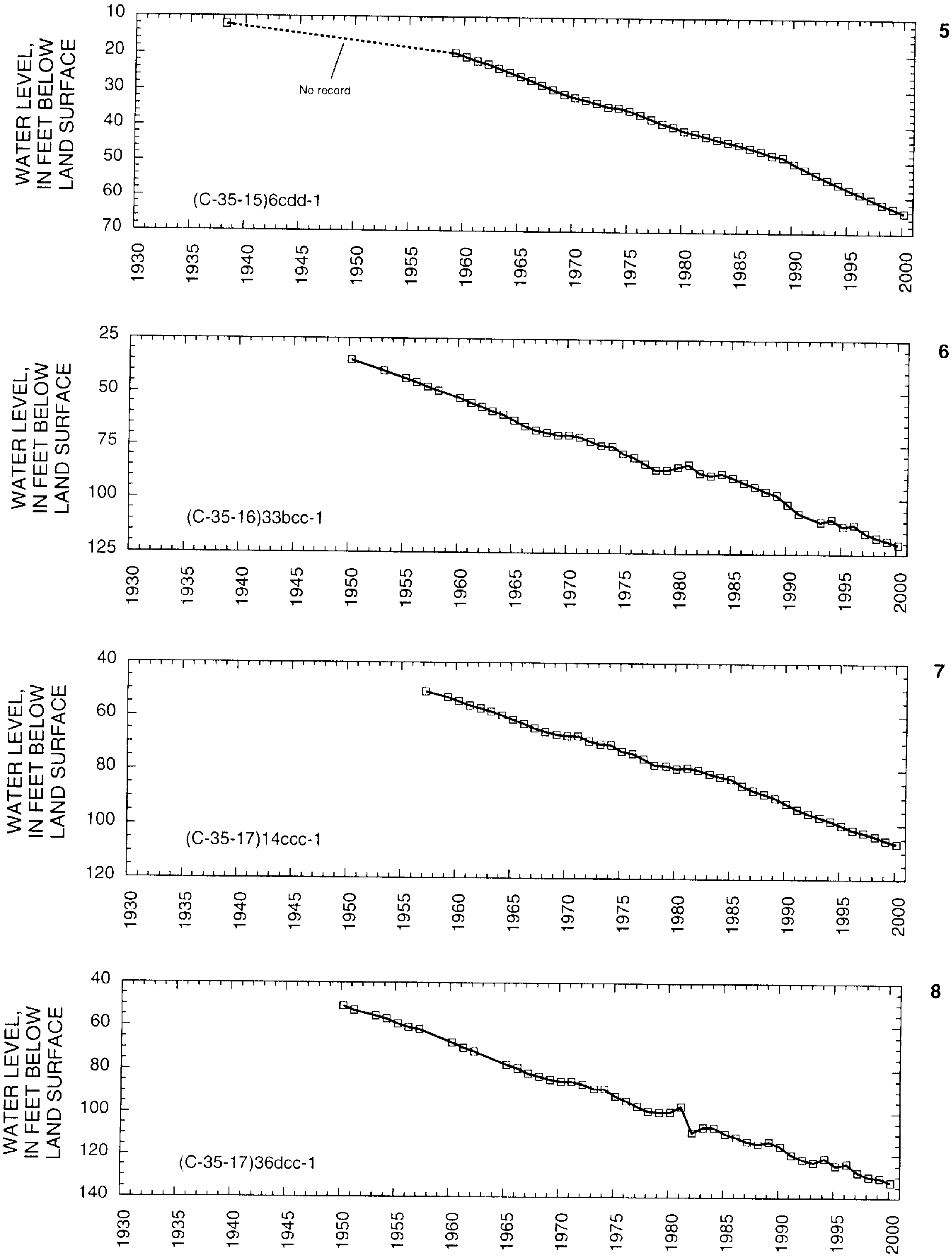


Figure 46. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Modena, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2—Continued.

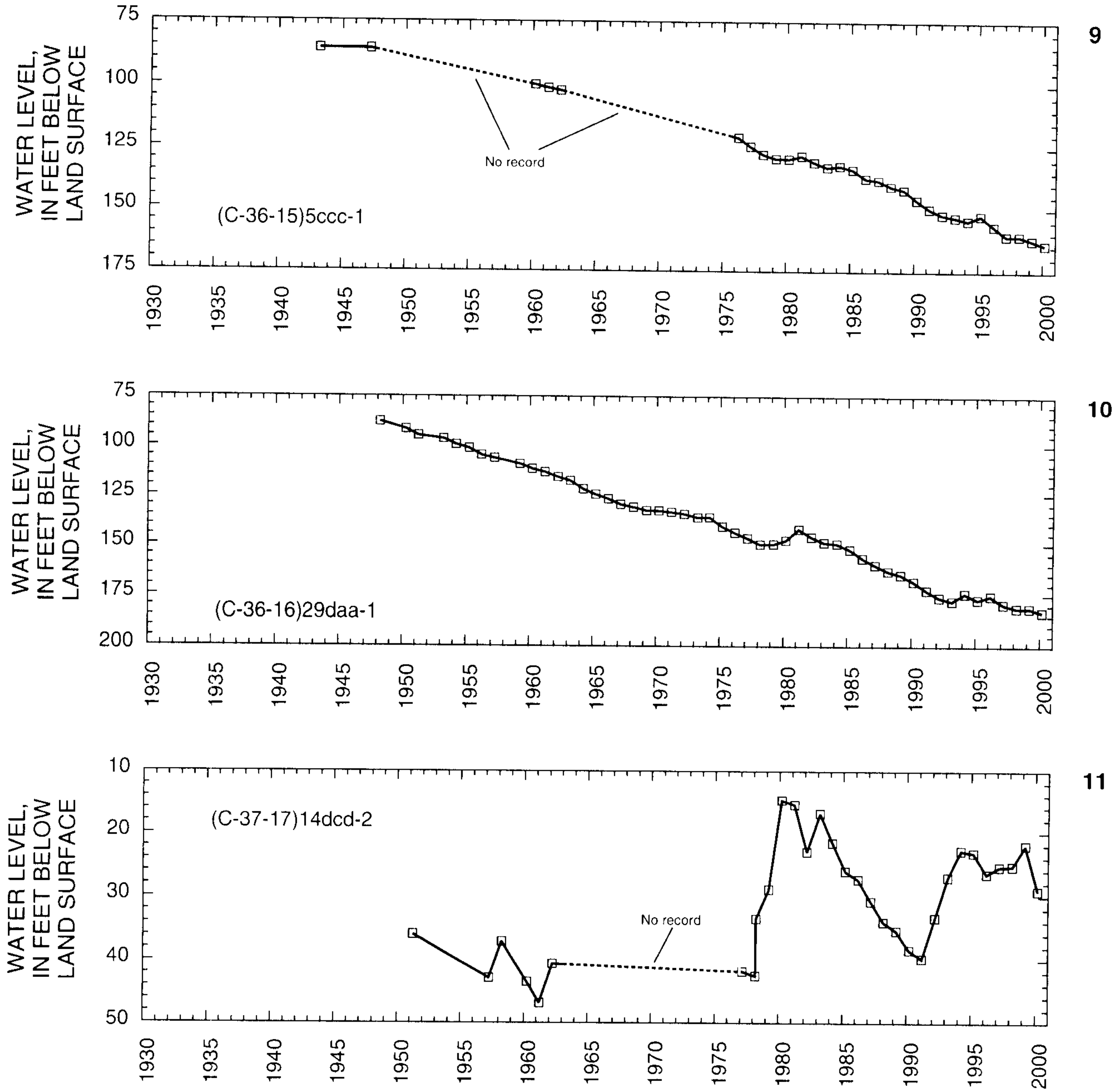


Figure 46. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Modena, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2—Continued.

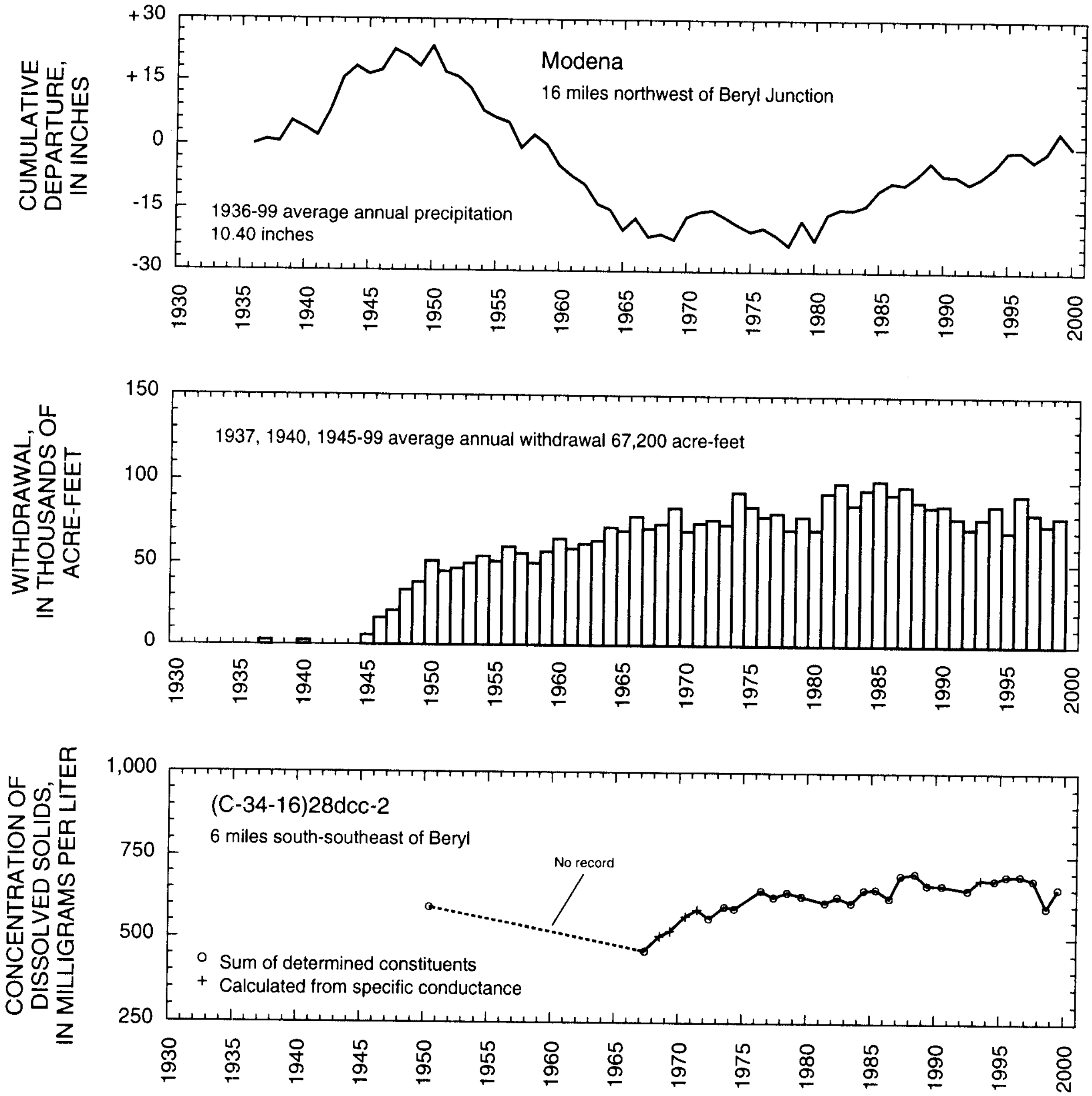


Figure 46. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Modena, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2—Continued.

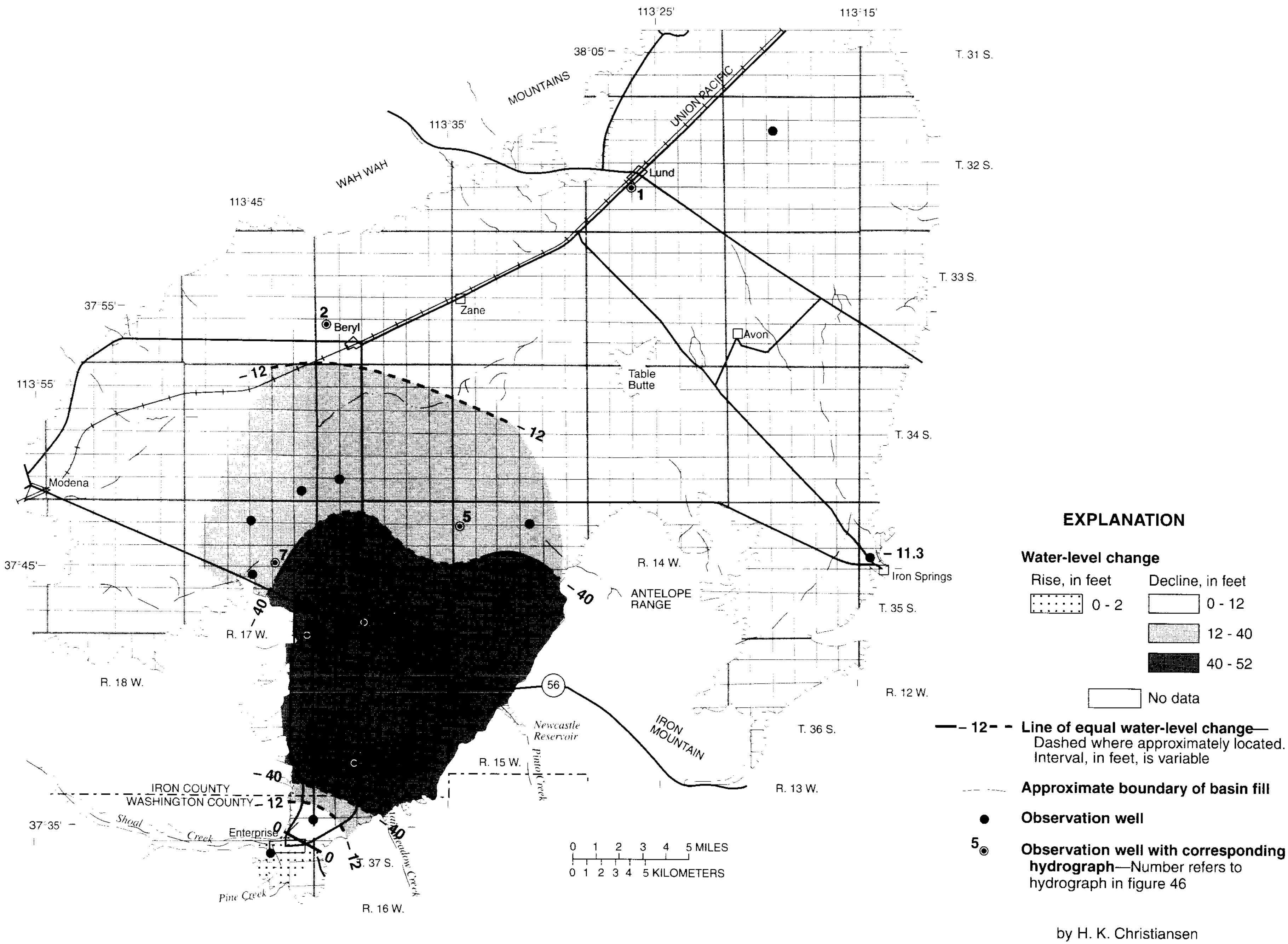


Figure 47. Map of the Beryl-Enterprise area showing change of water level from March 1970 to March 2000.

CENTRAL VIRGIN RIVER AREA

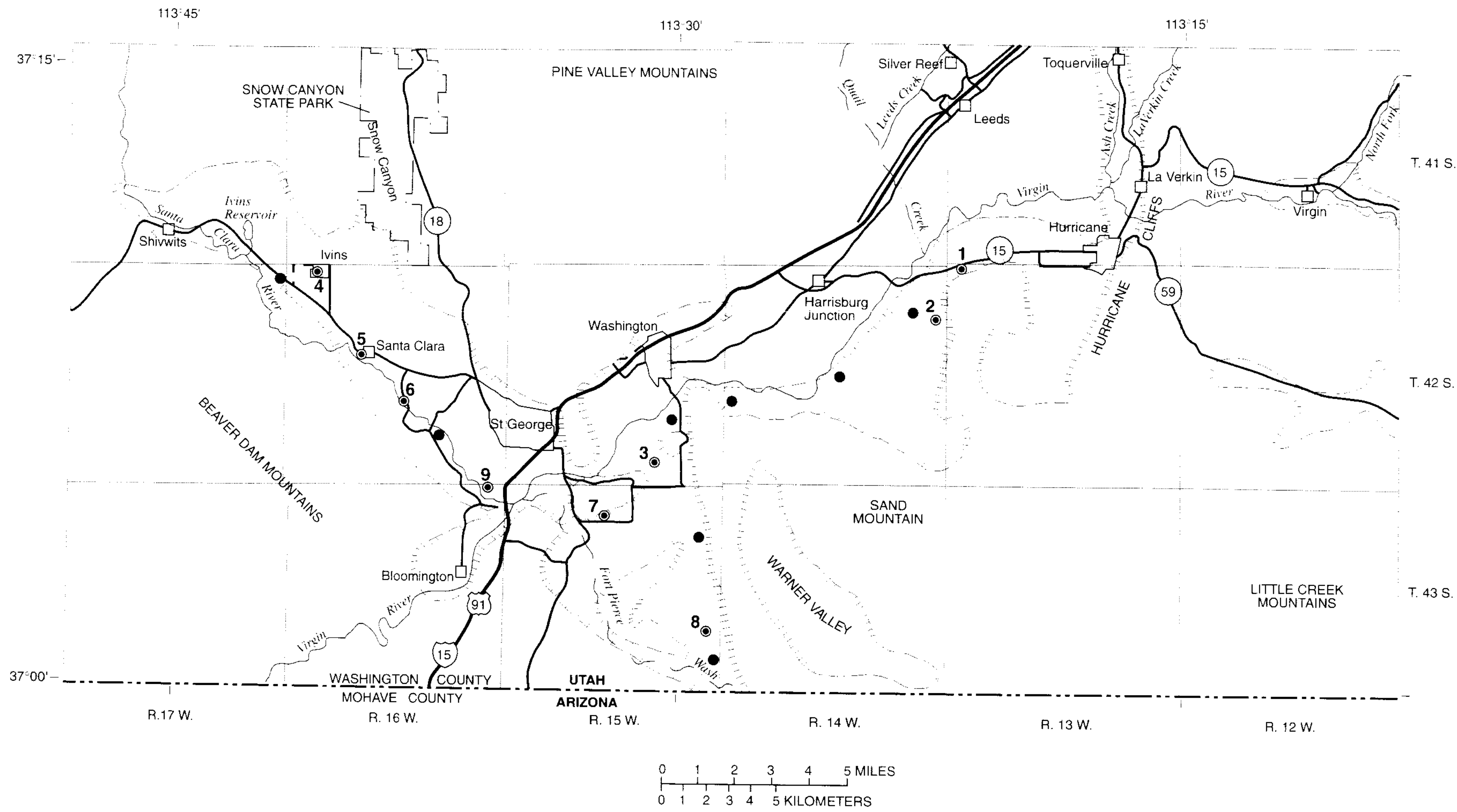
By H.K. Christiansen

The central Virgin River area is between the south end of the Pine Valley Mountains and the Hurricane Cliffs to the east and the White Hills to the southwest. Most of the wells measured are near the Virgin and Santa Clara Rivers.

Total estimated withdrawal of water from wells in the central Virgin River area in 1999 was about 28,000 acre-feet, which is 8,000 acre-feet more than was reported for 1998 and 11,000 acre-feet more than the average annual withdrawal for 1989-98 (tables 2 and 3). This withdrawal includes water from valley-fill aquifers used primarily for irrigation and water from consolidated rock and valley fill, which is used primarily for public supply. Withdrawal for irrigation in 1999 was about 200 acre-feet more than in 1998 and withdrawal for industry in 1999 was about 80 acre-feet more than in 1998. Withdrawal for public supply was 8,500 acre-feet more than the 1998 estimate.

The location of wells in which the water level was measured during February 1999 is shown in figure 48. The relation of the water level in selected wells to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17cba-1 is shown in figure 49. Long-term hydrographs for selected wells along the Santa Clara River and the Virgin River show that water levels measured in February have fluctuated with no general trend. The water-level fluctuations are likely caused by recharge from the Santa Clara and Virgin Rivers. The water level in well (C-43-15)25ddd-1, in the Fort Pierce Wash area, has declined the most, about 87 feet since 1961; and the water level in well (C-42-14)12dbb-1, about 4 miles southeast of Harrisburg Junction, has declined more than 15 feet since 1991. These declines are probably the result of increased local withdrawal for irrigation. Discharge of the Virgin River at Virgin in 1999 was about 91,800 acre-feet, which is 101,400 acre-feet less than the revised value of 193,200 acre-feet for 1998 and about 43,400 acre-feet less than the long-term average for 1931-70, 1979-99. Precipitation at St. George in 1999 was 5.52 inches, which is 2.57 inches less than the average annual precipitation for 1947-99 and 8.45 inches less than in 1998. The concentration of dissolved solids in water from well (C-41-17)17cba-1 indicates little overall change since 1966.

Water-level changes from February 1970 to February 2000 are shown in figure 50. The only notable change took place southeast of St. George where the water level has declined almost 73 feet. Declines are probably the result of continued large withdrawals for irrigation.



EXPLANATION

Approximate boundary of valley-fill deposits

● Observation well

3◉ **Observation well with corresponding hydrograph**—Number refers to hydrograph in figure 49

Figure 48. Location of wells in the central Virgin River area in which the water level was measured during February 2000.

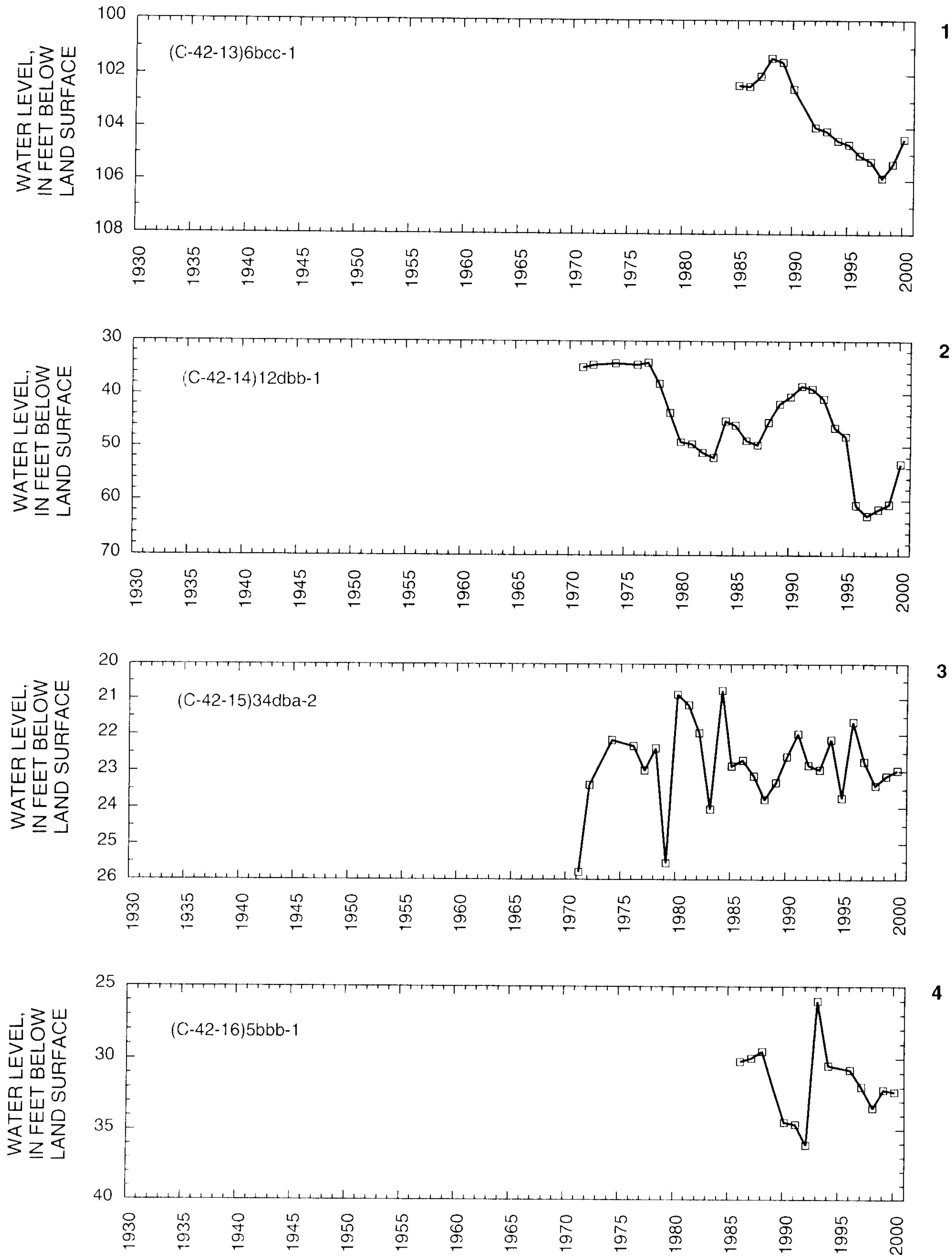


Figure 49. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17cba-1.

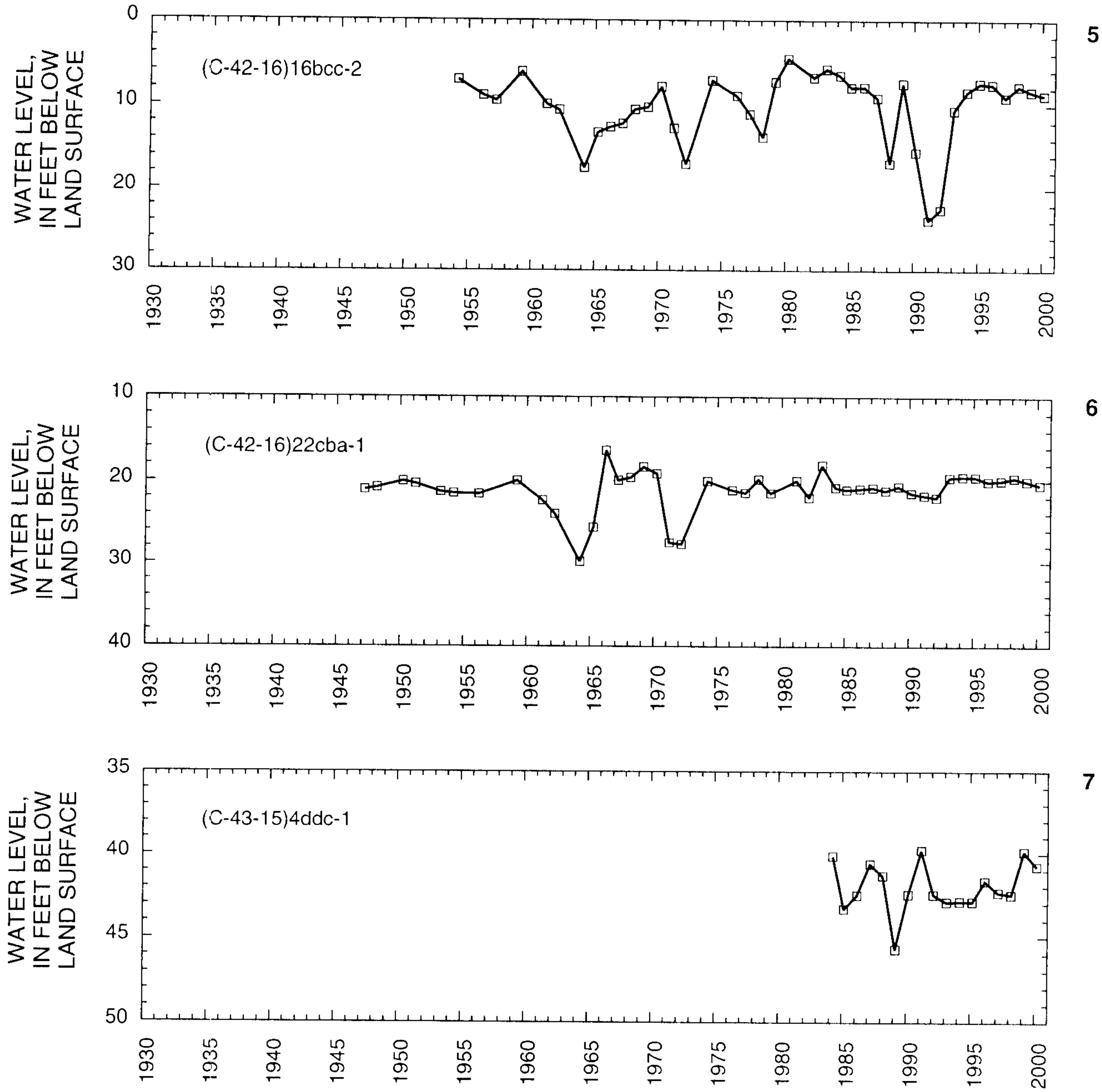


Figure 49. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17cba-1—Continued.

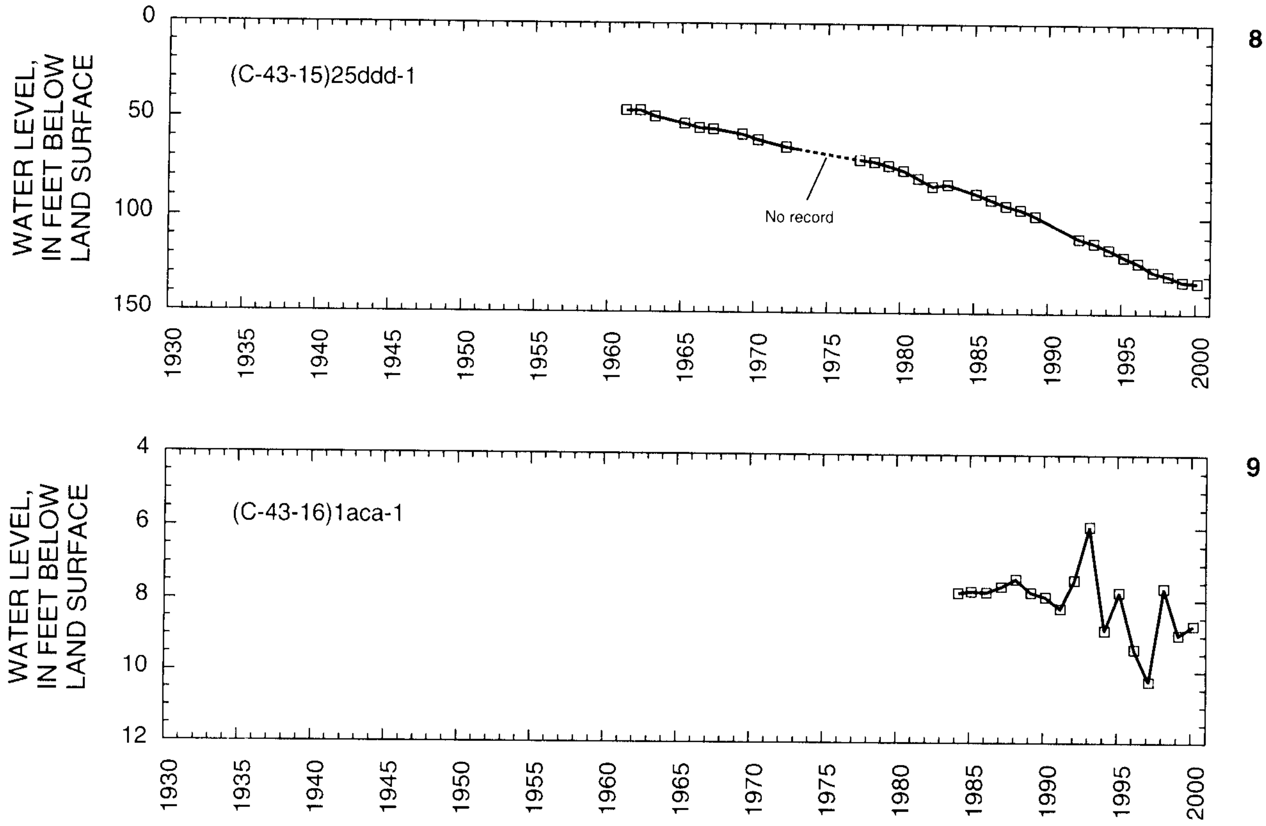


Figure 49. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17cba-1—Continued.

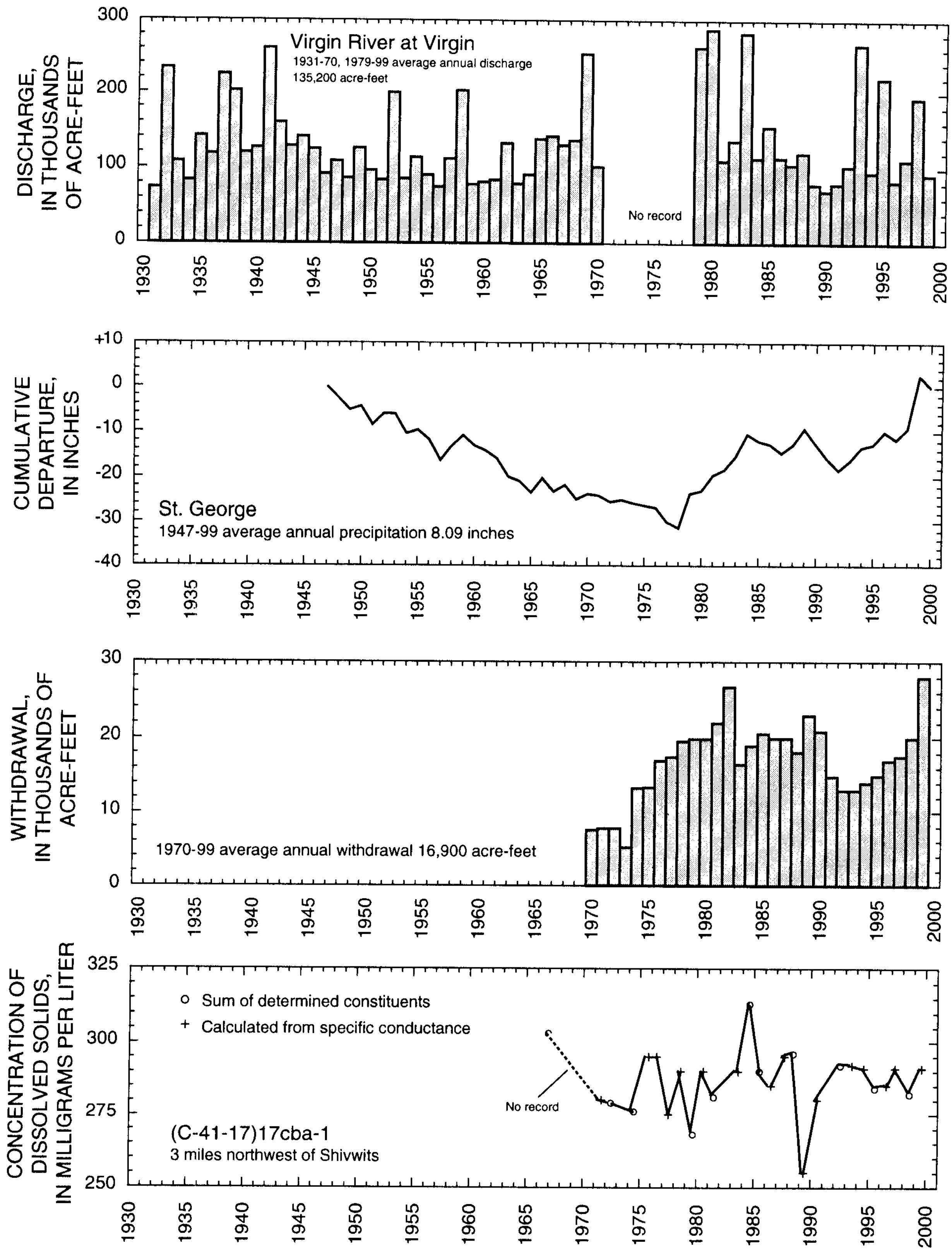
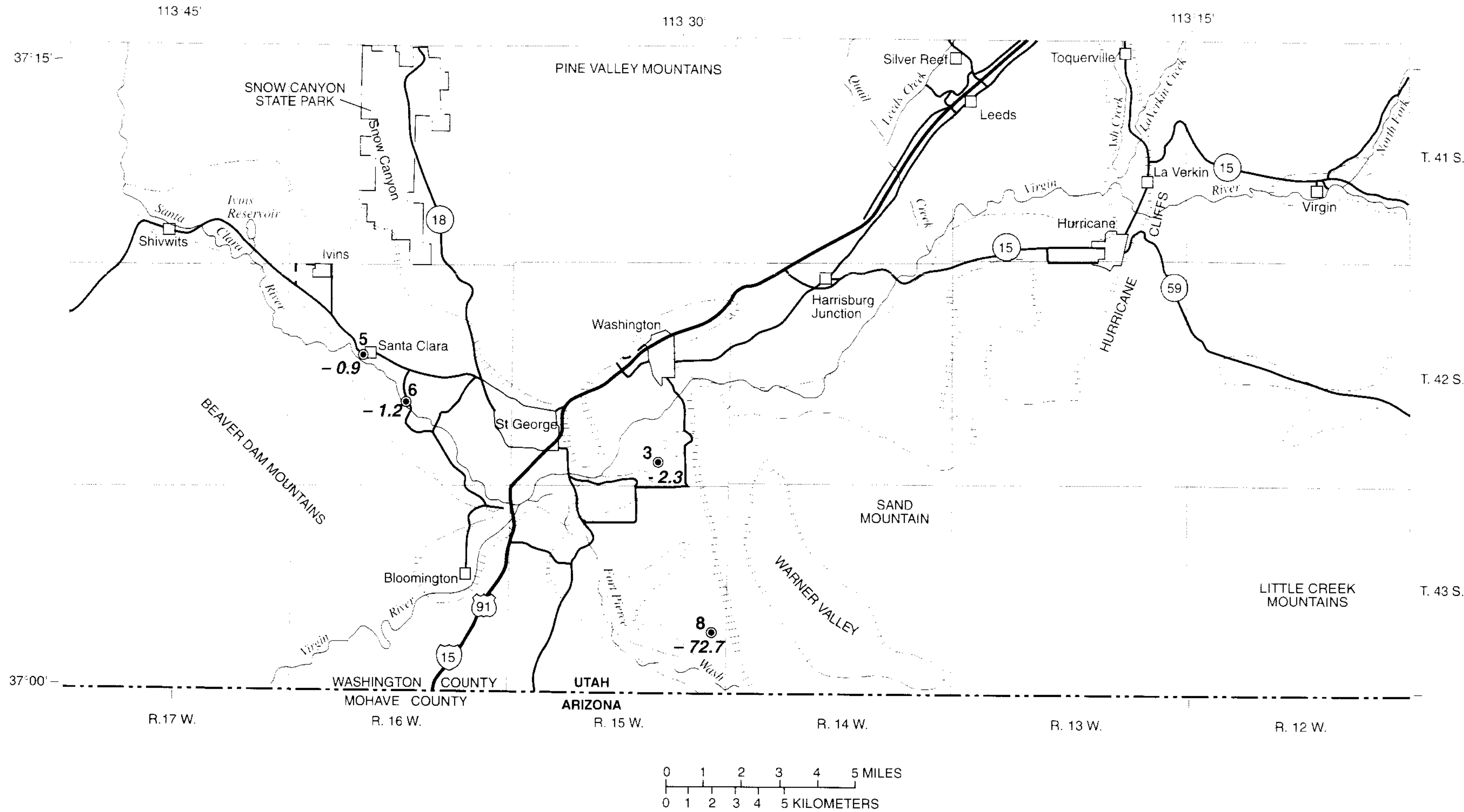


Figure 49. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17cba-1—Continued.



EXPLANATION

Approximate boundary of valley-fill deposits

8
– 72.7 **Observation well with corresponding hydrograph**—Number refers to hydrograph in figure 49; Bold-Italic number is water-level change, in feet

by H. K. Christiansen

Figure 50. Map of the central Virgin River area showing change of water level from February 1970 to February 2000.

OTHER AREAS

By M.J. Fisher

Total estimated withdrawal of water from wells in the areas of Utah listed below in 1999 was about 106,000 acre-feet, which is 7,000 acre-feet more than the estimate for 1998 and the same as the average annual withdrawal for 1989-98 (tables 2 and 3). In the areas listed below, withdrawal in 1999 was greater than in 1998 except in Park Valley, Ogden Valley, Sanpete Valley; and the Dugway area, Skull Valley, and Old River Bed. The increase in withdrawal resulted from increased irrigation and public supply use.

The location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2000 is shown in figure 51. The relation of the water level in wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield is shown in figure 52. Water levels in the selected wells generally rose during the 1970s. Water levels rose sharply from the early to mid-1980s as a result of greater-than-average precipitation but generally have declined since the mid-1980s because of continued withdrawal and less precipitation. Water levels rose in most of the selected wells from 1999-2000. The rises probably resulted from decreased irrigation withdrawals and greater-than-average precipitation. Water levels generally rose from March 1970 to March 2000 throughout Cedar Valley (fig. 53). The greatest rise was located in the area northeast of Fairfield. The rise probably resulted from generally greater-than-average precipitation since 1976.

The location of wells in Sanpete Valley in which the water level was measured during March 2000 is shown in figure 54. The relation of the water level in wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti is shown in figure 55. Water levels in many of the selected wells rose from the late 1970s to the mid-1980s as a result of greater-than-average precipitation and have declined since the mid-1980s. Water levels declined in most of the selected wells during 1999-2000. The declines probably resulted from increased withdrawal for irrigation during 1999 and less-than-average precipitation. Water levels generally declined from March 1970 to March 2000 throughout Sanpete Valley (fig. 56). The decline is probably the result of increased withdrawals for irrigation, industry, and public use.

The relation of the water level in selected wells in the remaining areas of Utah (see accompanying table) to cumulative departure from average annual precipitation at sites in or near those areas is shown in figure 57. Water levels generally declined in most of the selected observation wells from 1999 to 2000. The declines probably resulted from increased withdrawals for public supply and local irrigation. Water-level rises in some of the areas from 1999 to 2000 probably resulted from greater-than-average precipitation and (or) increased local recharge from surface water.

Water levels generally rose during 1996-2000 in most of the selected wells in "Other Areas". Rises probably resulted from generally greater-than-average precipitation during this period. The declining water-level trends for this period in some areas probably resulted from lesser amounts of local recharge.

		Estimated withdrawal (acre-feet) 1999					
Number in figure 1	Area	Irrigation	Industrial	Public supply	Domestic and stock	1999 total	1998 total
1	Grouse Creek Valley	3,900	0	0	20	3,900	3,300
2	Park Valley	2,200	0	0	10	2,200	2,500
4	Malad-lower Bear River Valley	4,500	1,000	2,500	200	8,200	6,200
8	Ogden Valley	0	0	11,600	20	11,600	12,400
13	Rush Valley	4,600	0	300	30	4,900	4,500
14	Dugway area, Skull Valley, and Old River Bed	1,500	3,100	3,800	10	8,400	8,500
15	Cedar Valley, Utah County	5,000	0	100	40	5,100	4,300
20	Sanpete Valley	3,100	520	430	4,000	8,100	8,300
25	Snake Valley	6,700	0	150	50	6,900	6,800
27	Beaver Valley	8,800	20	280	490	9,600	8,400
	Remainder of State	14,000	7,430	13,600	2,500	37,500	33,800
Total (rounded)		54,300	12,100	32,800	7,400	106,000	99,000

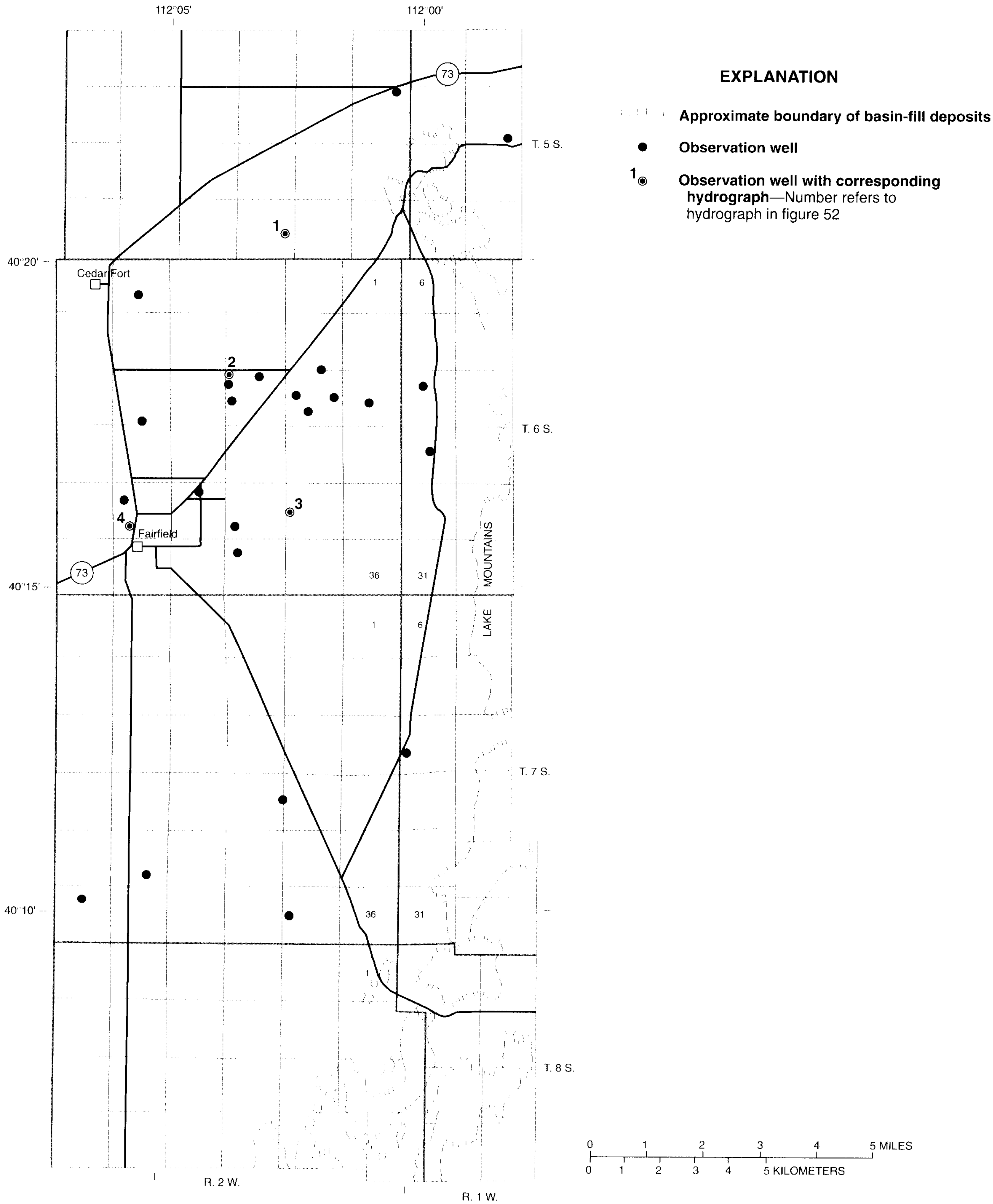


Figure 51. Location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2000.

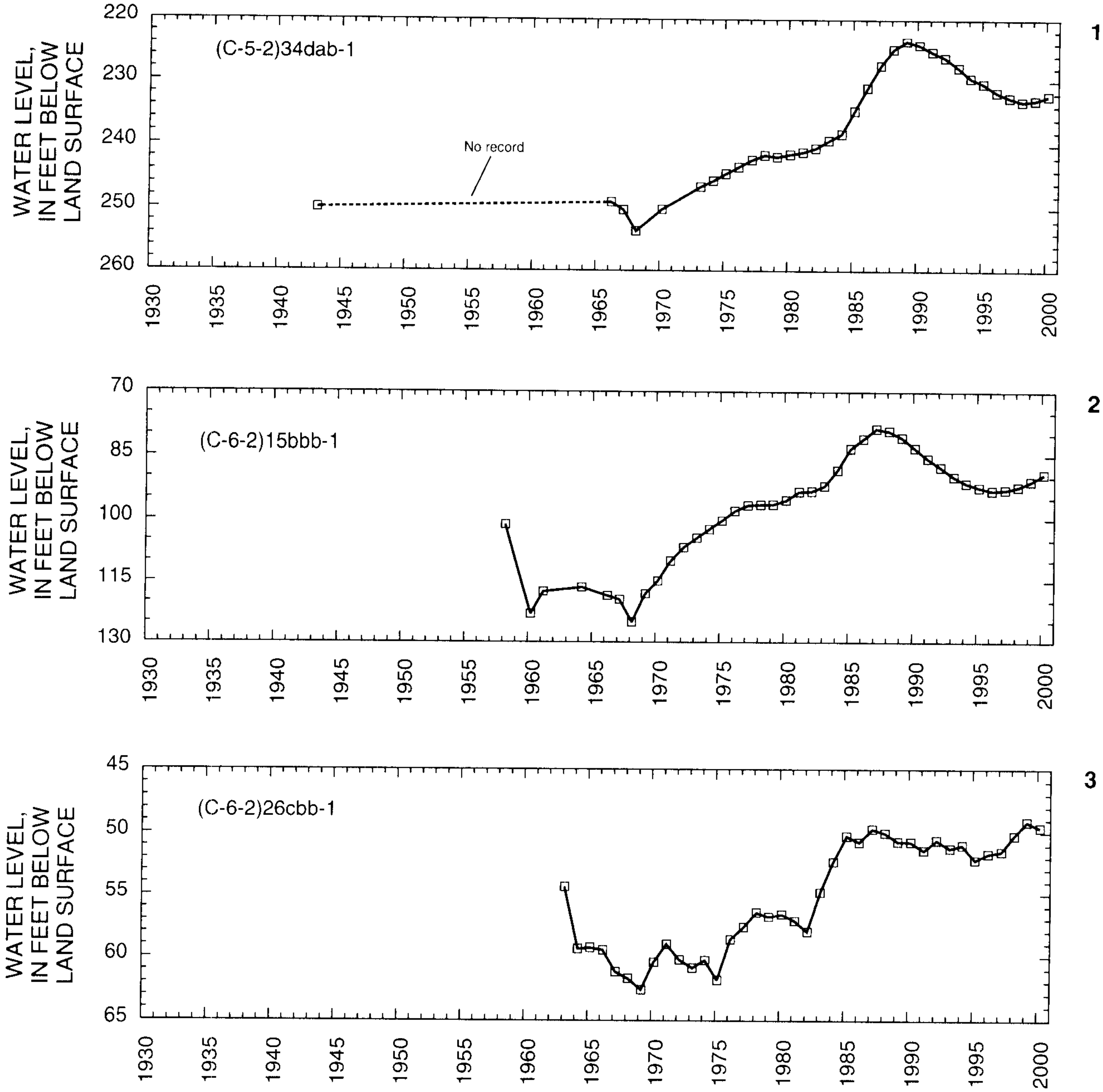
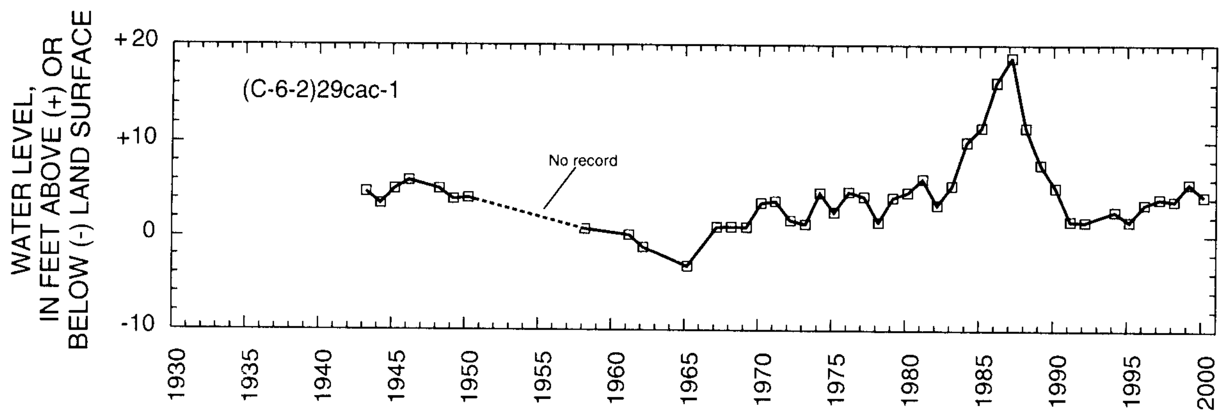


Figure 52. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield.



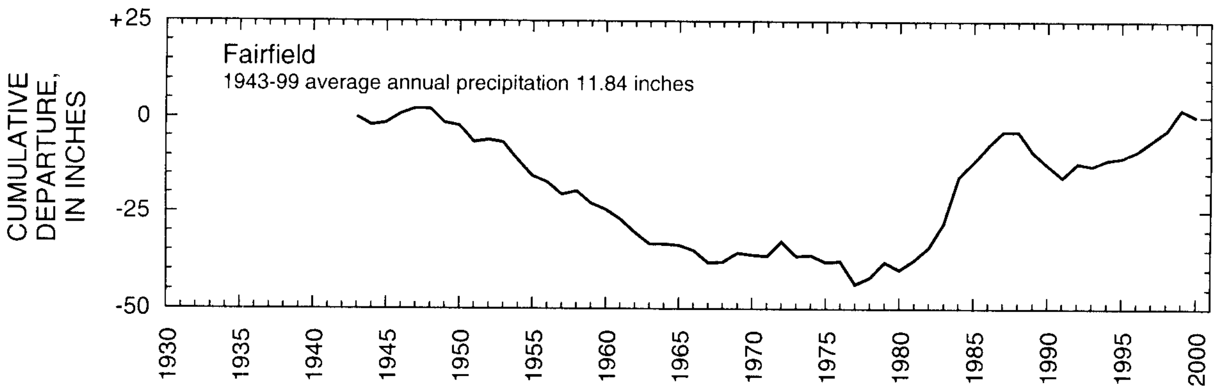


Figure 52. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield—Continued.

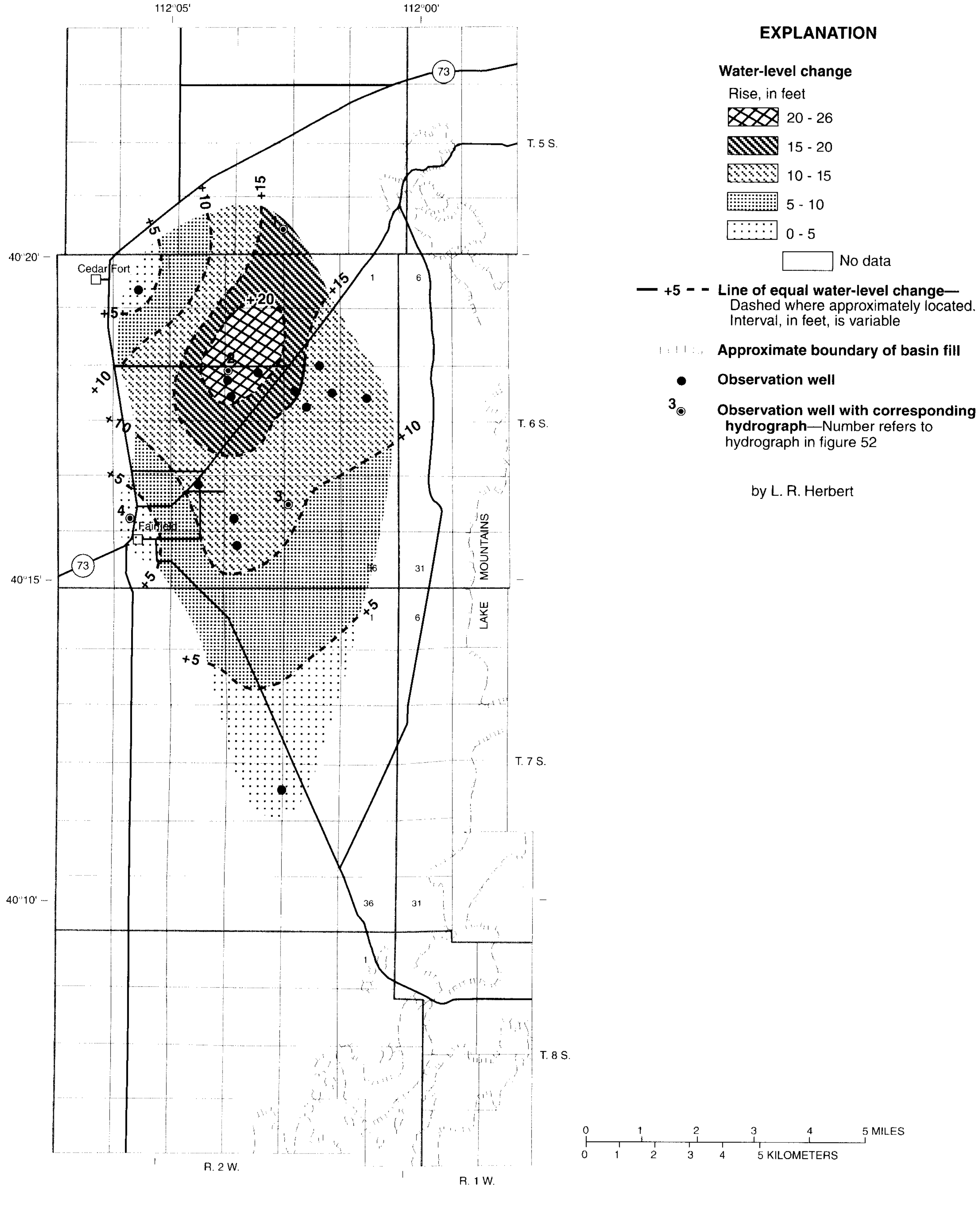


Figure 53. Map of Cedar Valley, Utah County, showing change of water level from March 1970 to March 2000.

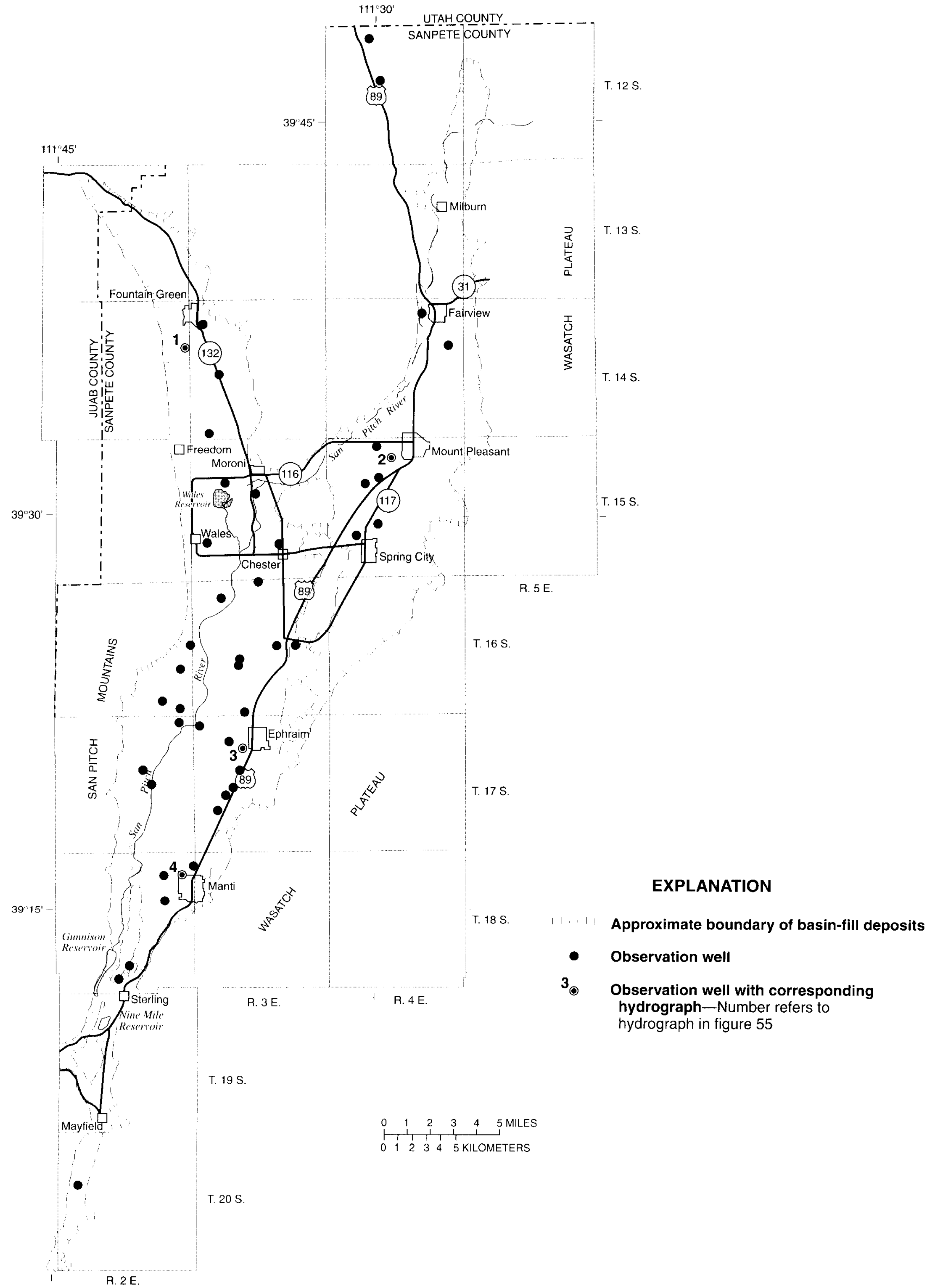


Figure 54. Location of wells in Sanpete Valley in which the water level was measured during March 2000.

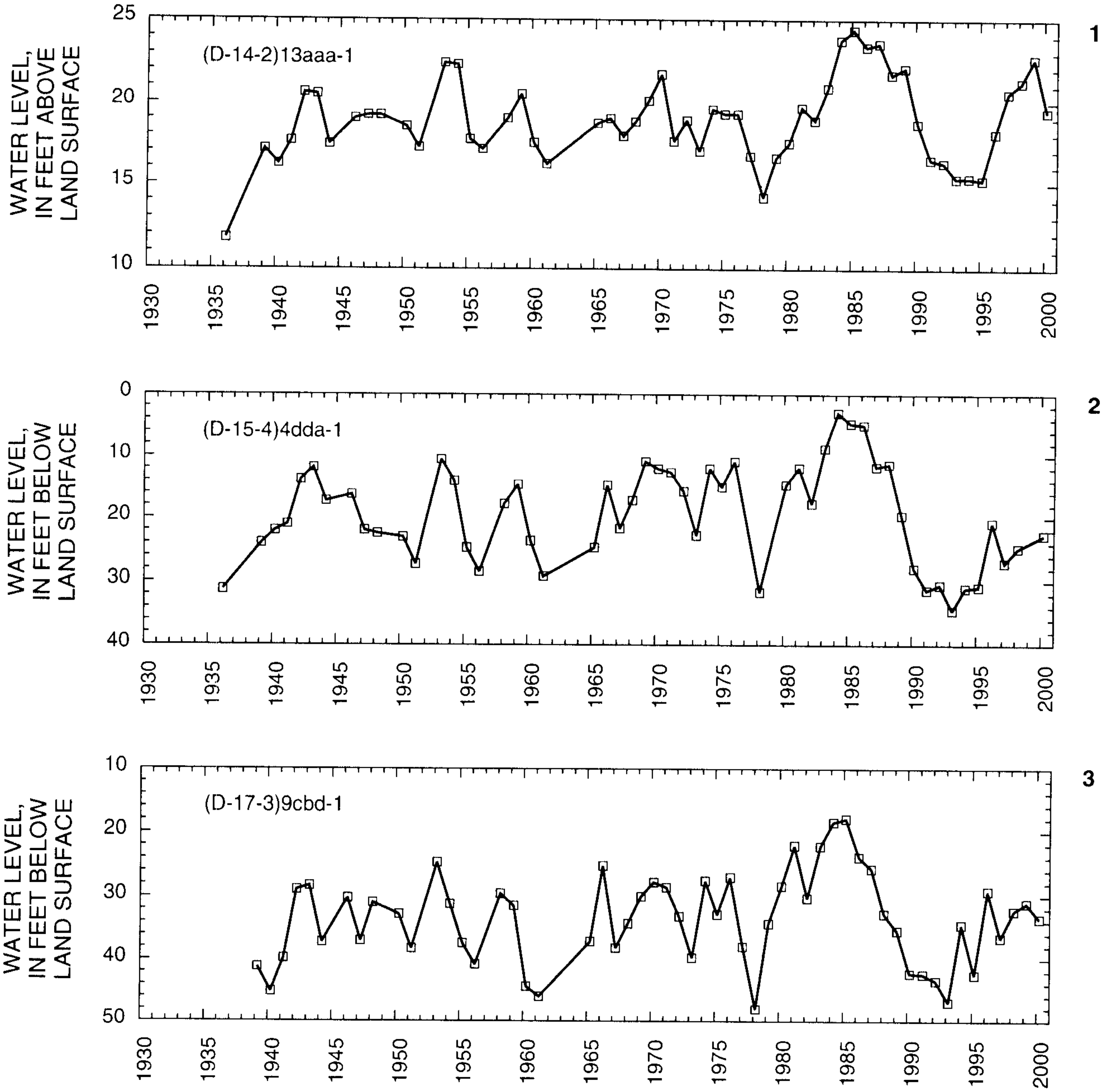


Figure 55. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti.

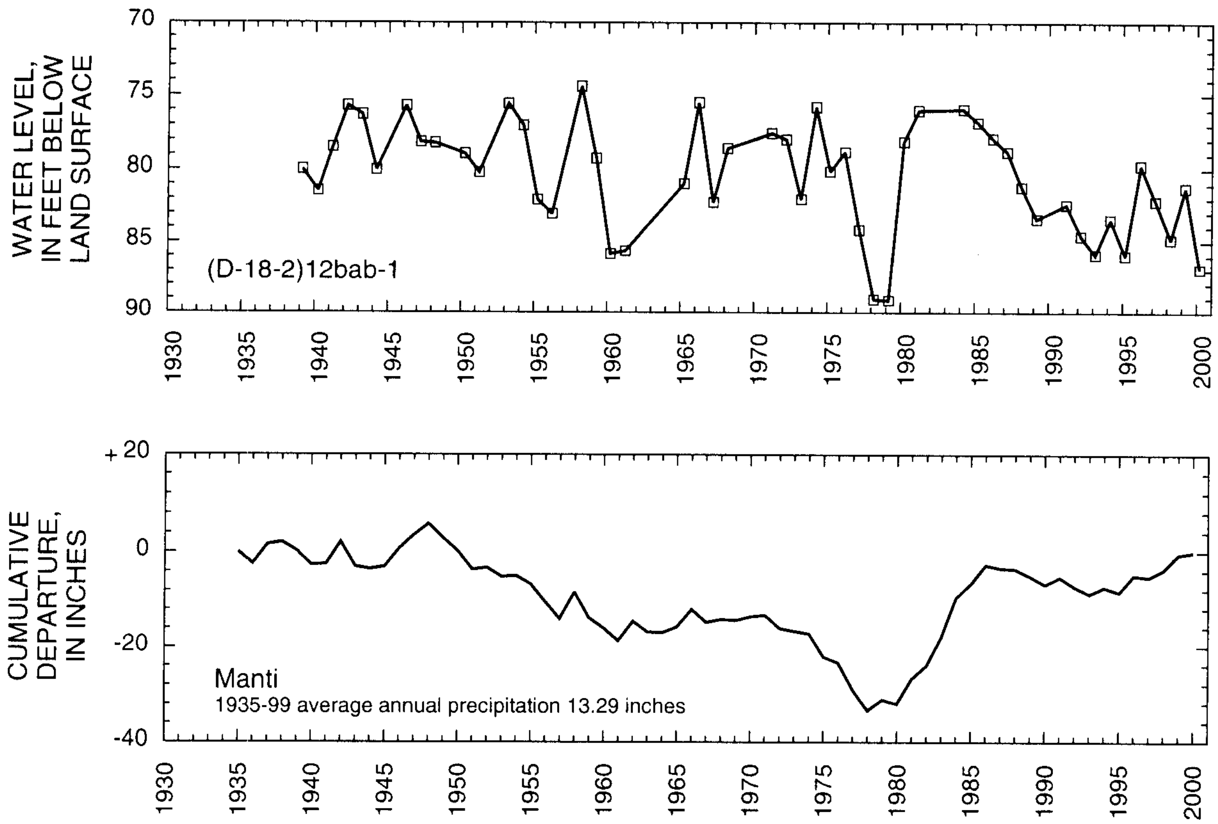


Figure 55. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti–Continued.

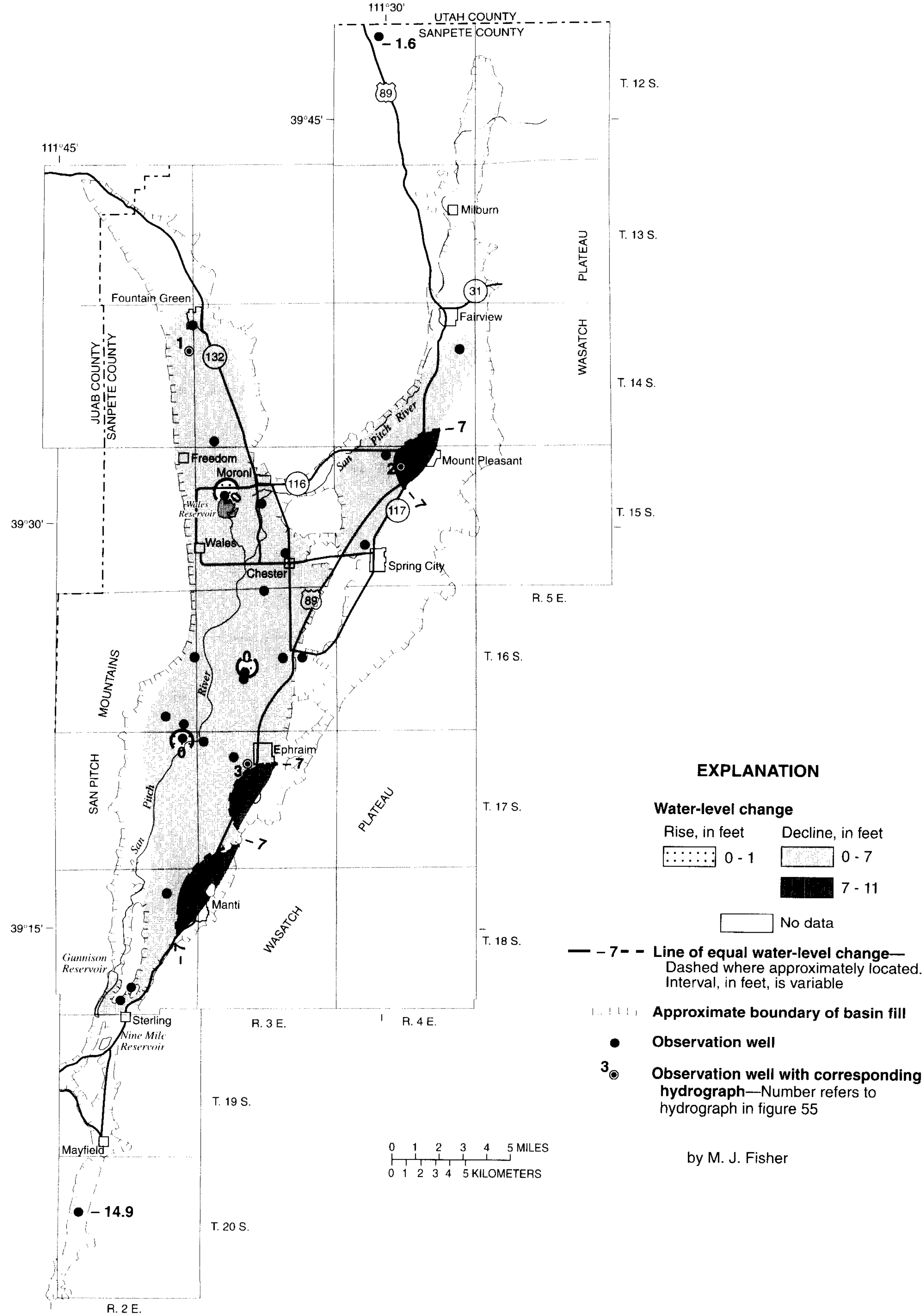


Figure 56. Map of Sanpete Valley showing change of water level from March 1970 to March 2000.

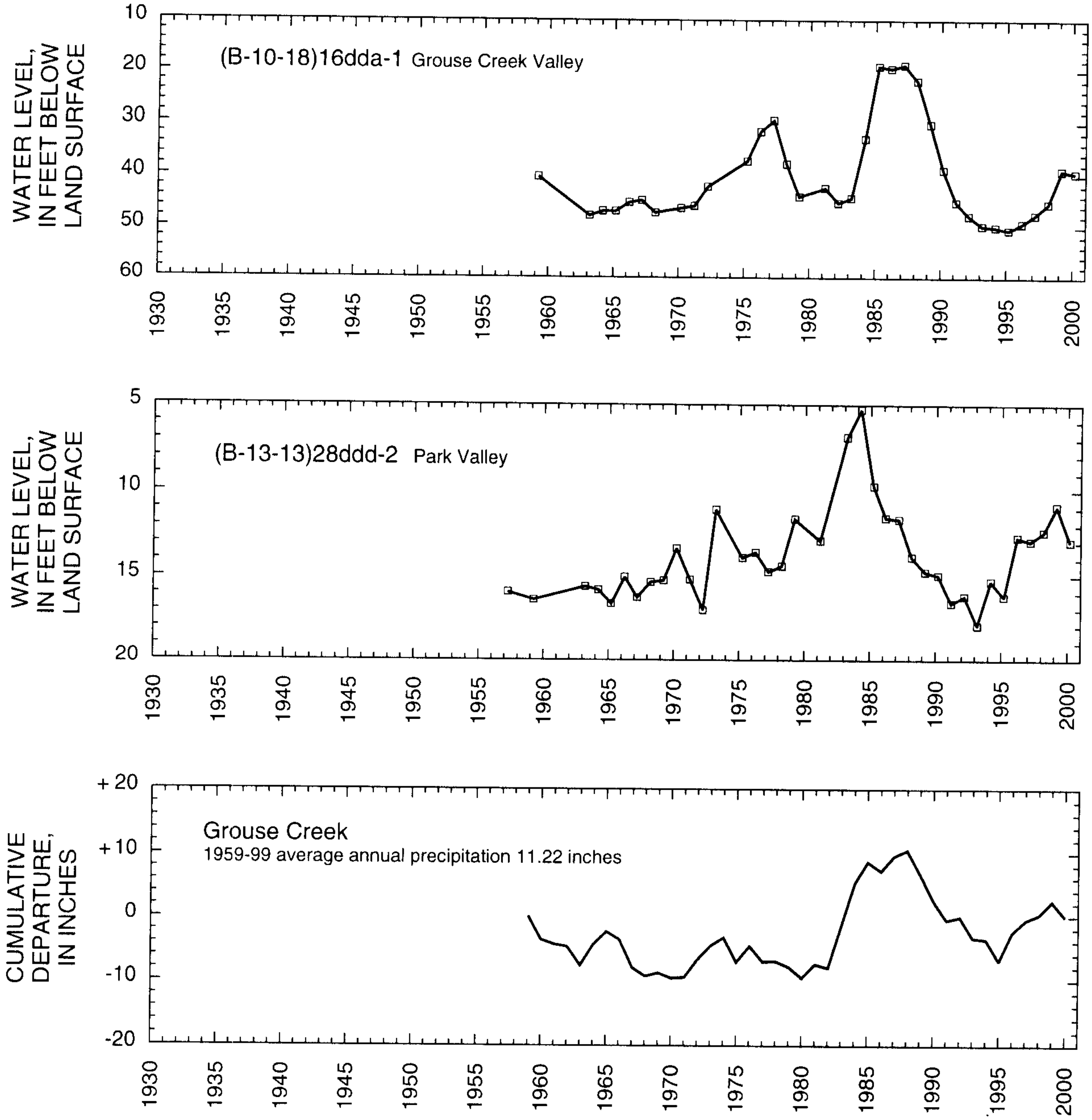


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.

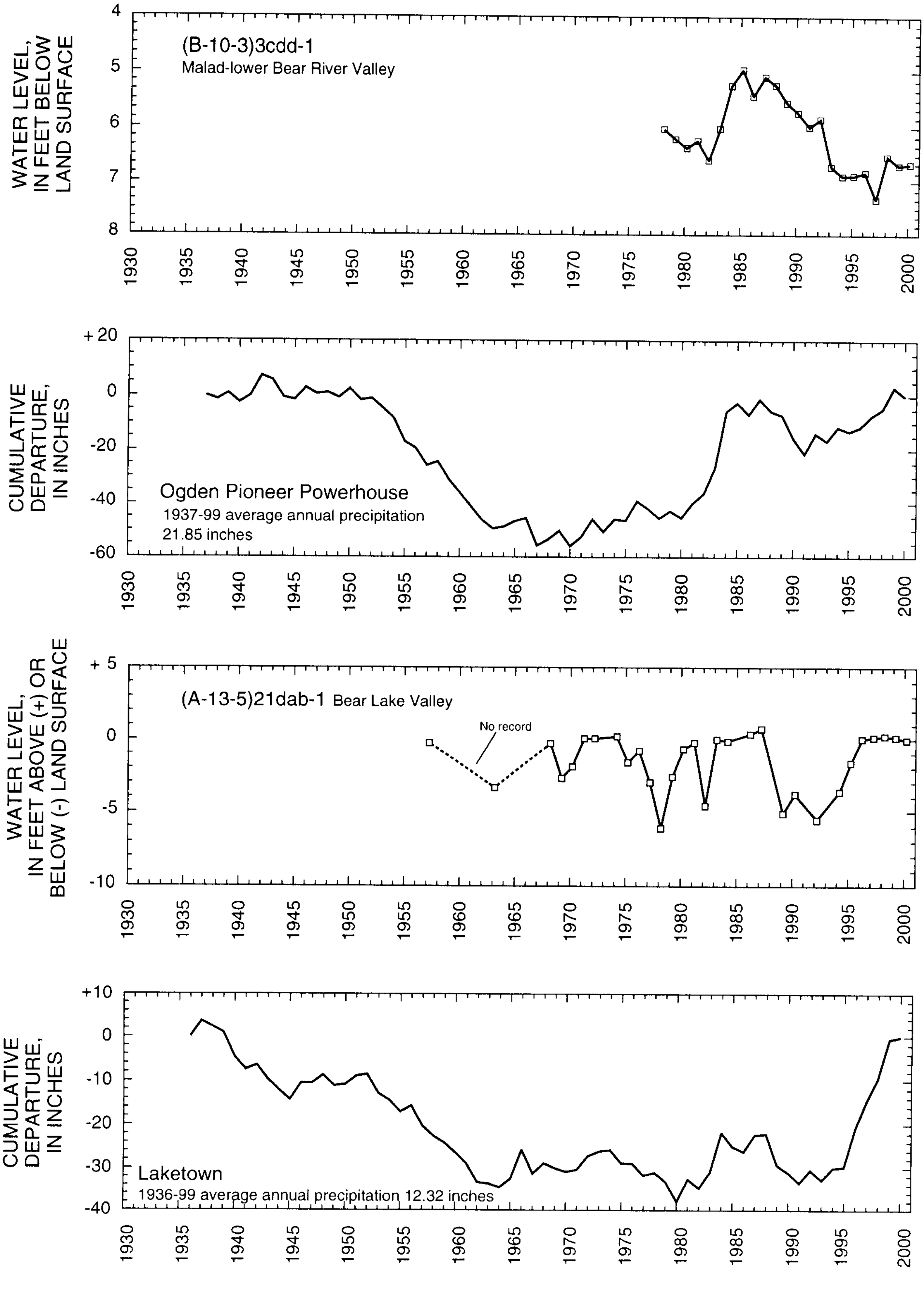


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

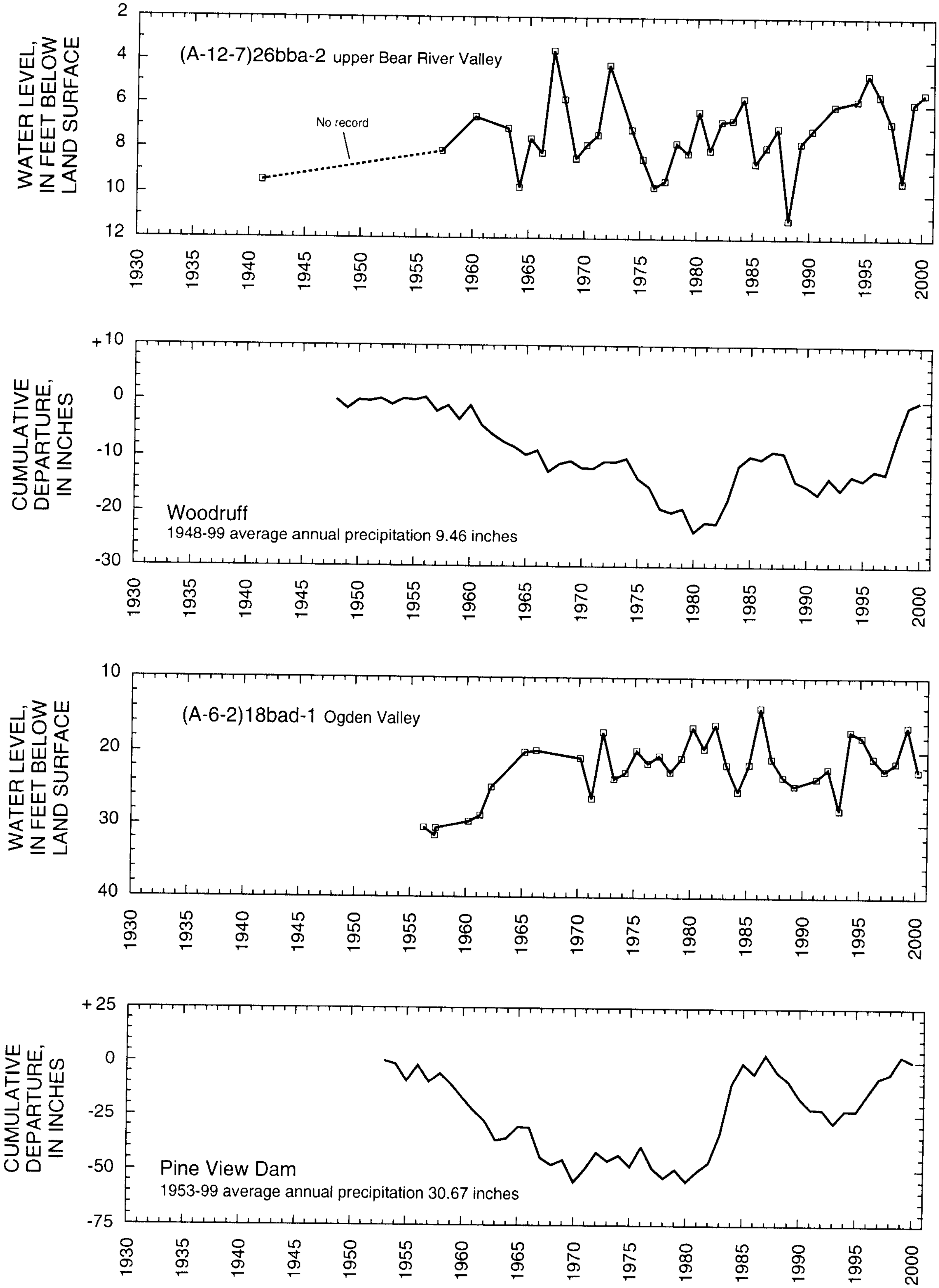


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

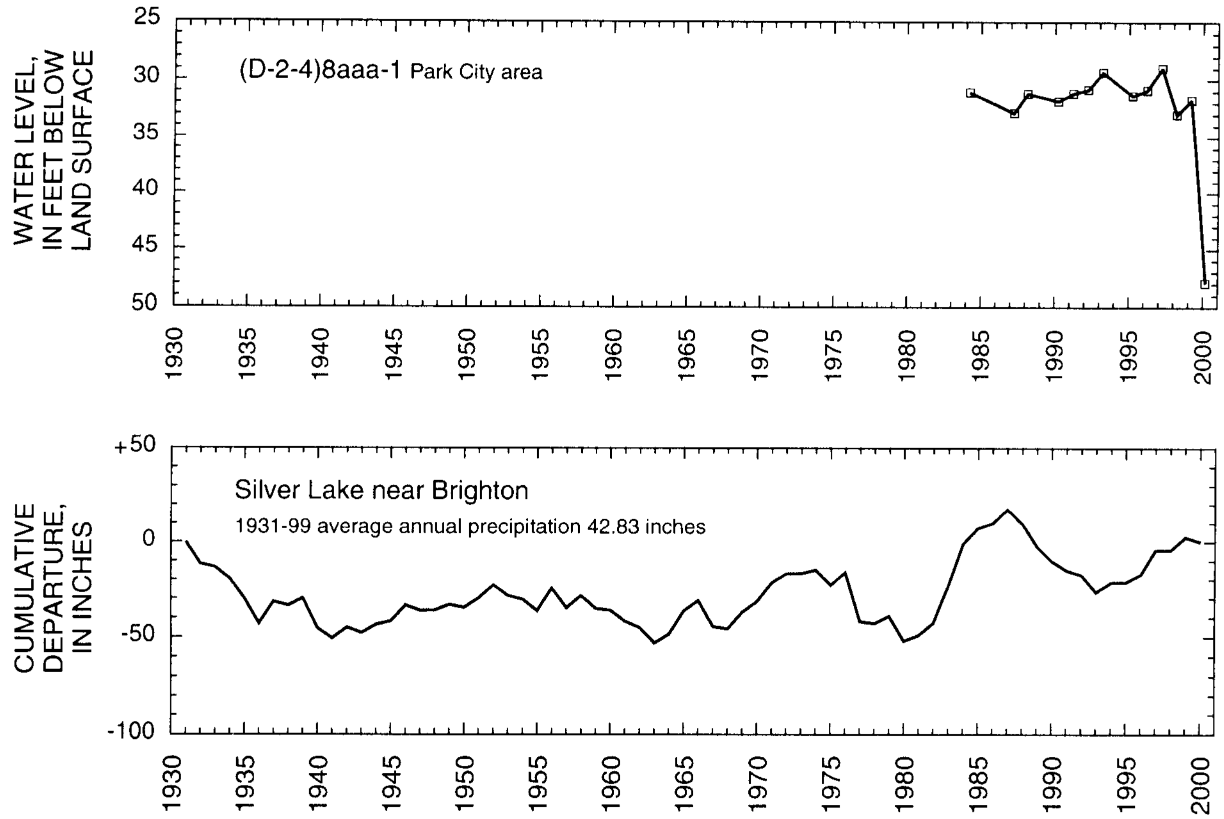
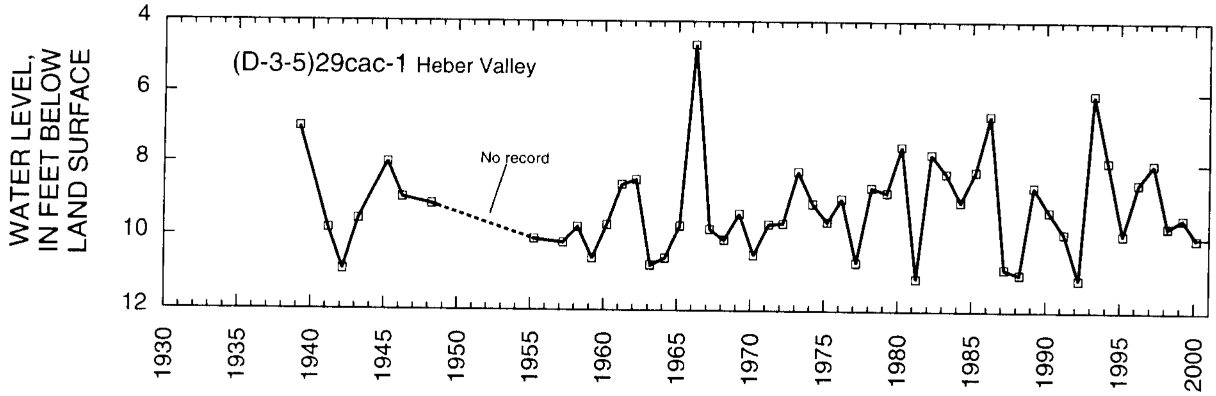
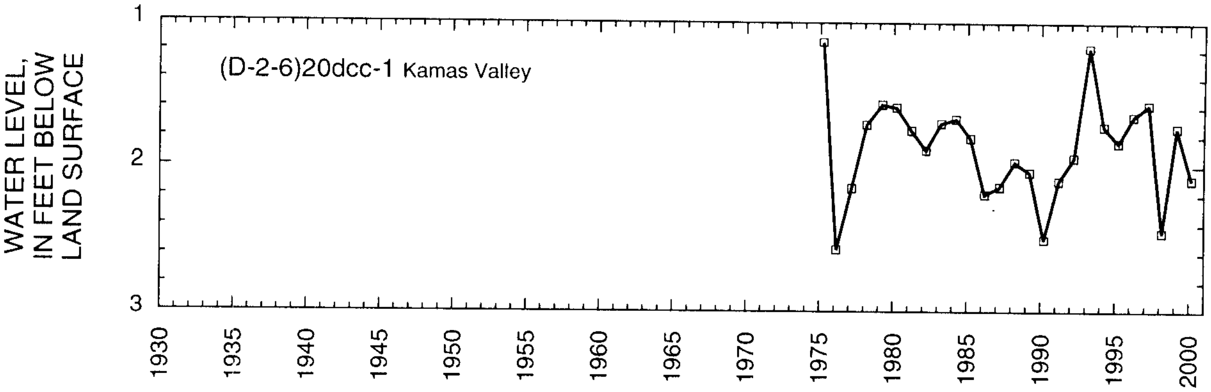


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.





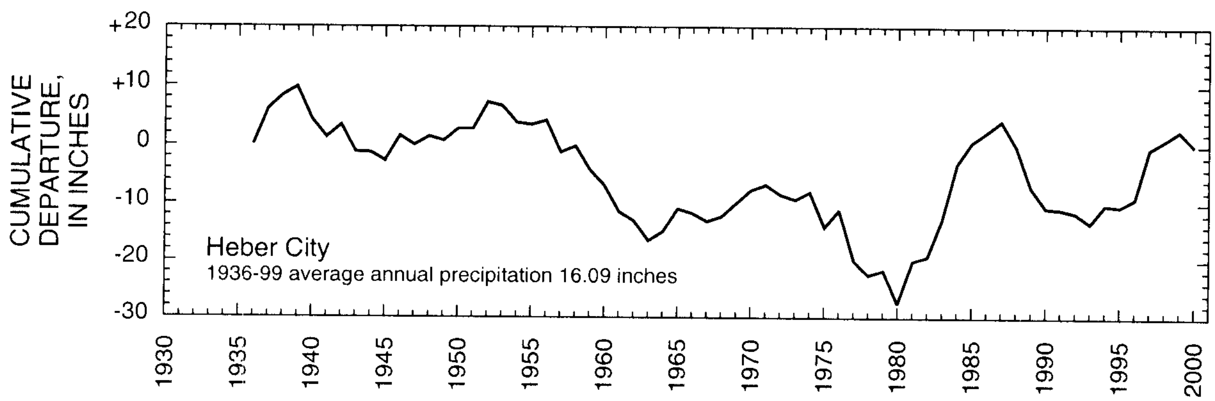


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

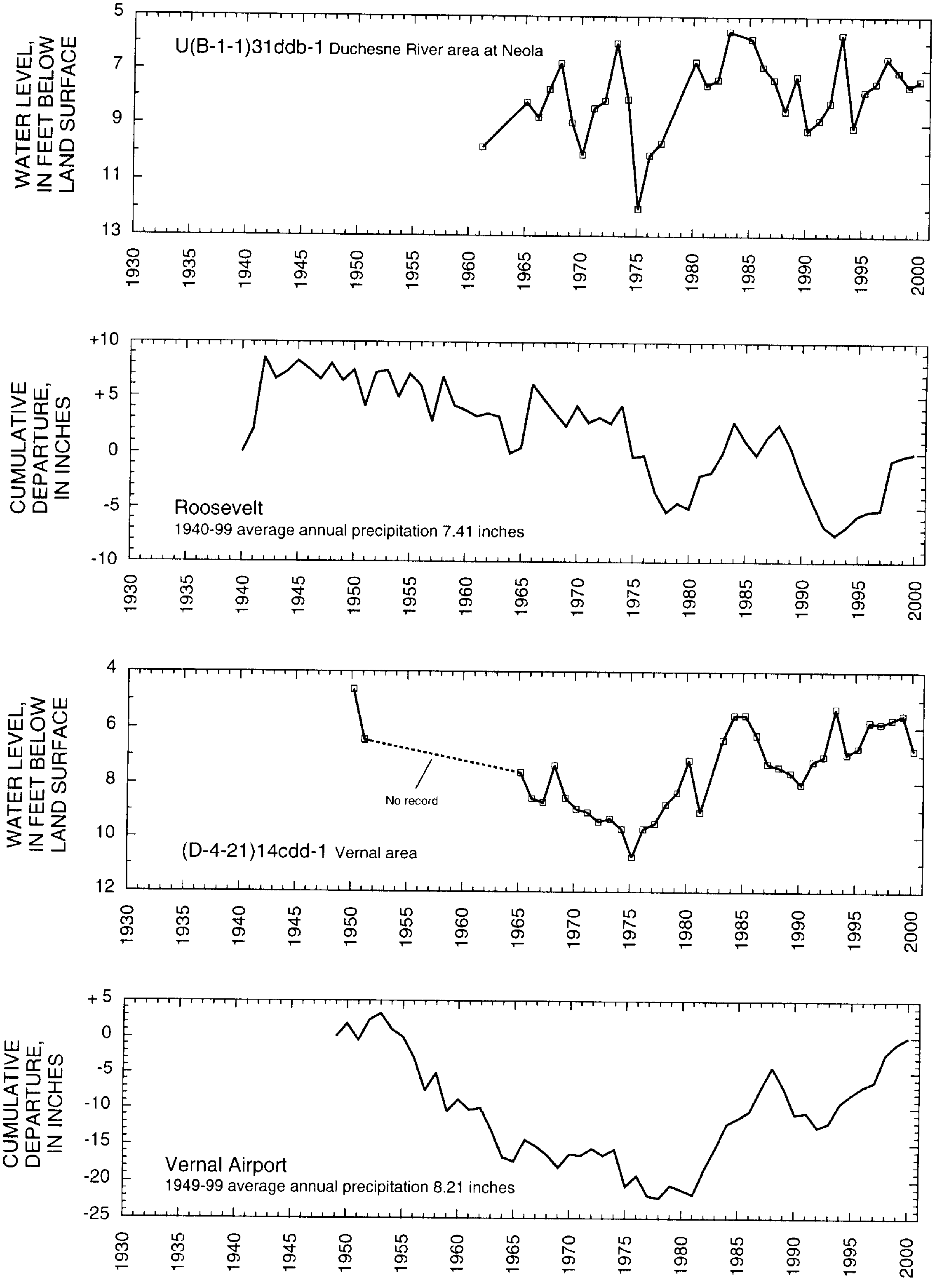


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

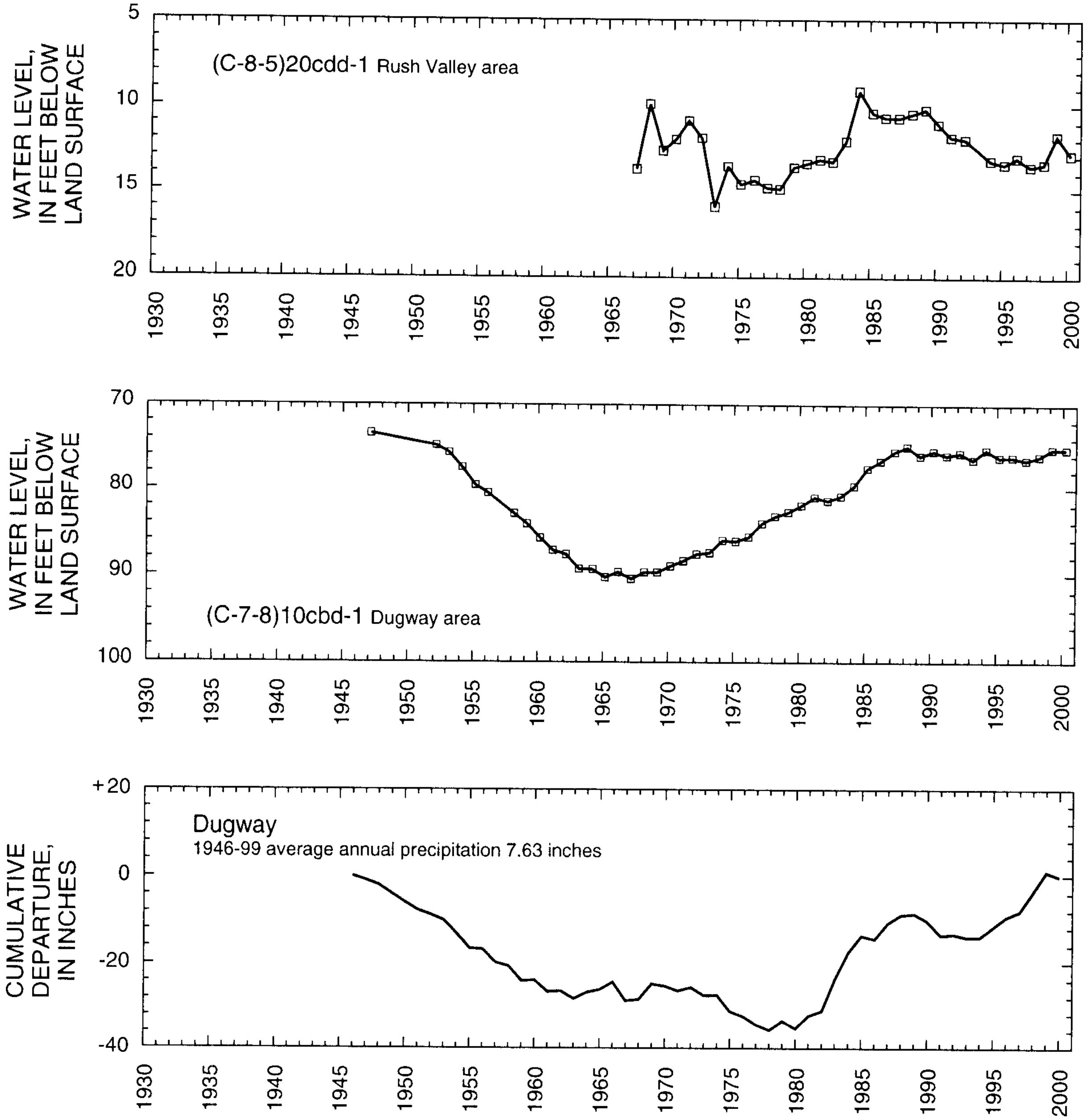


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

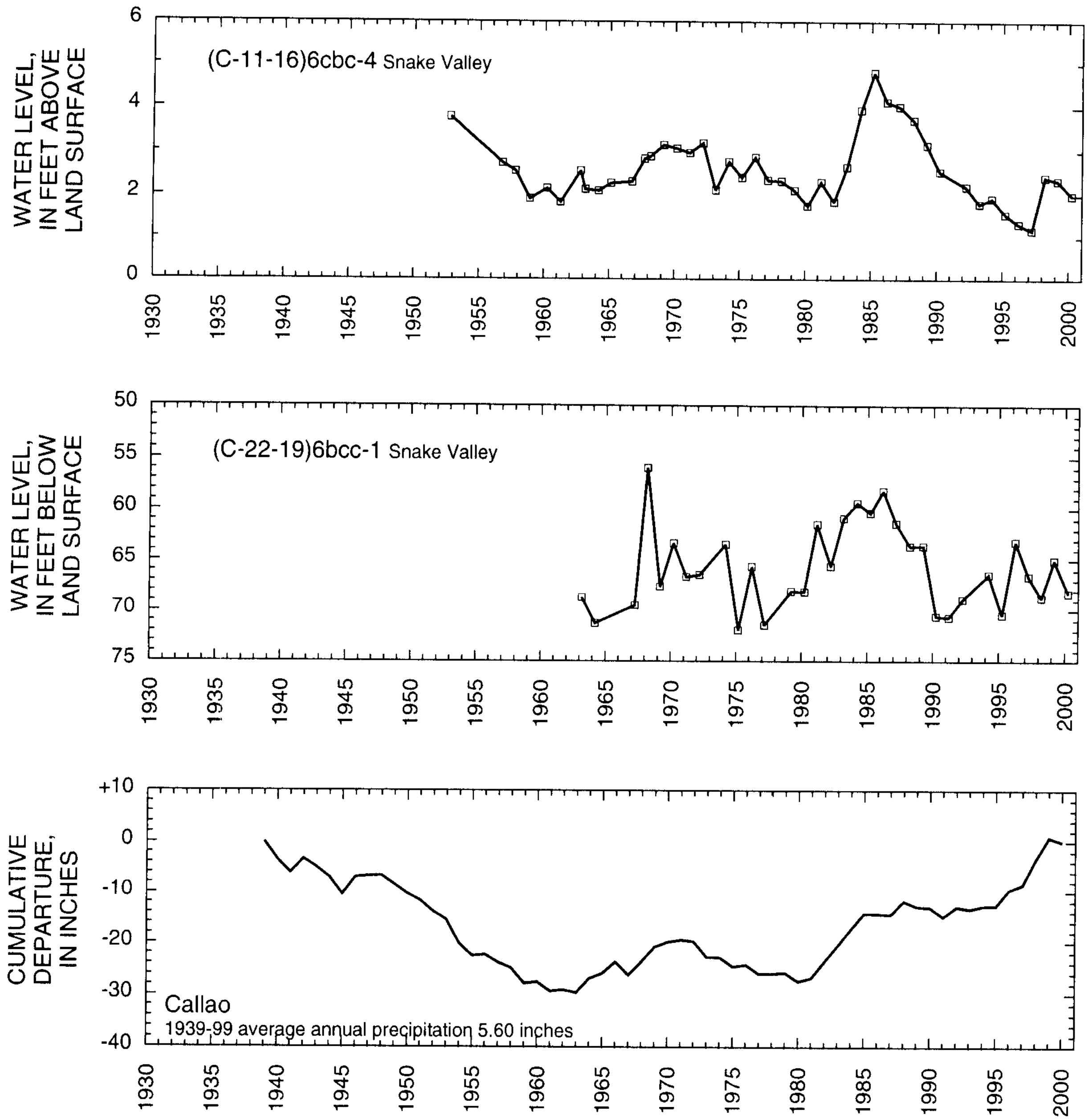


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

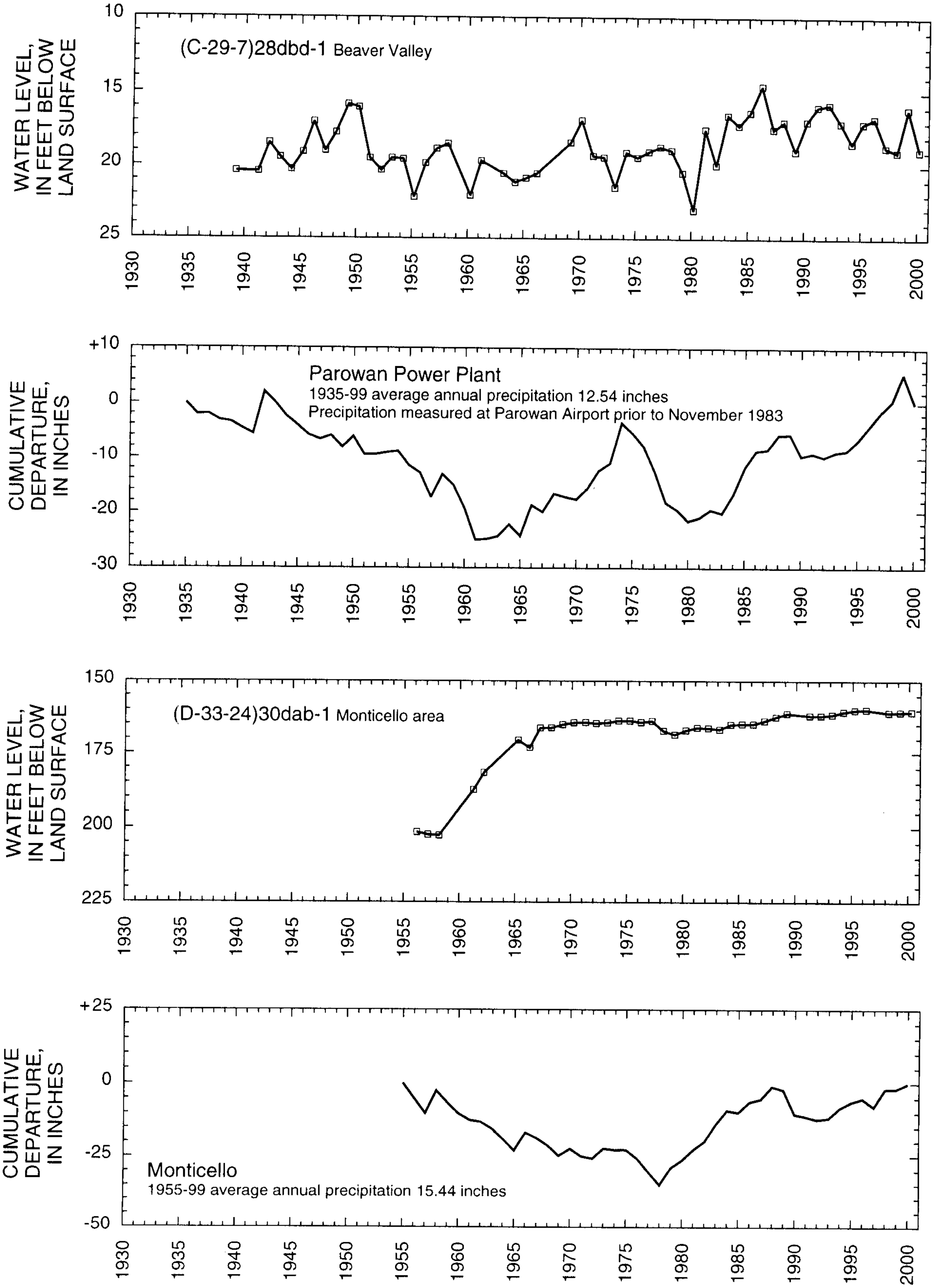


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

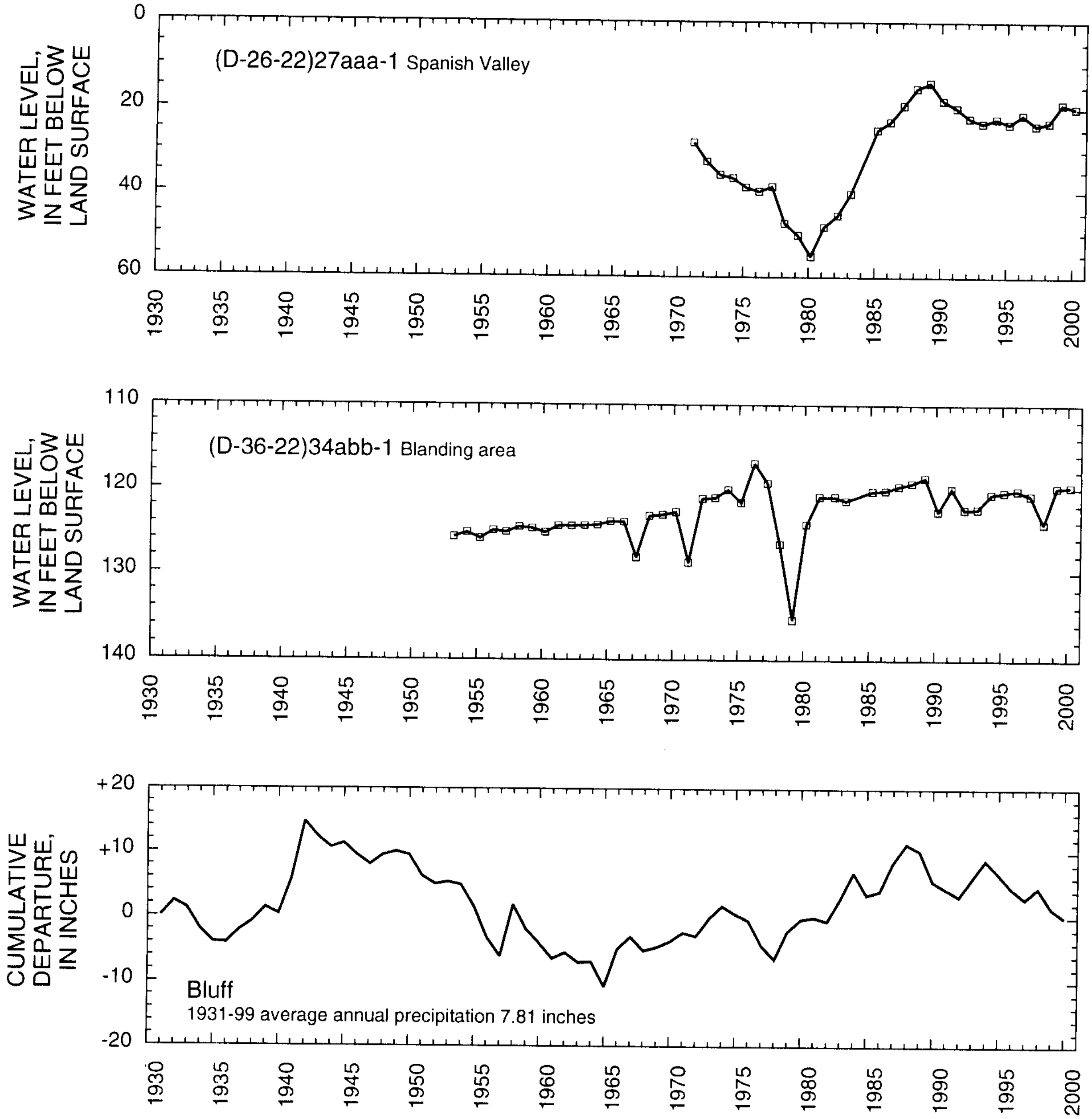


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

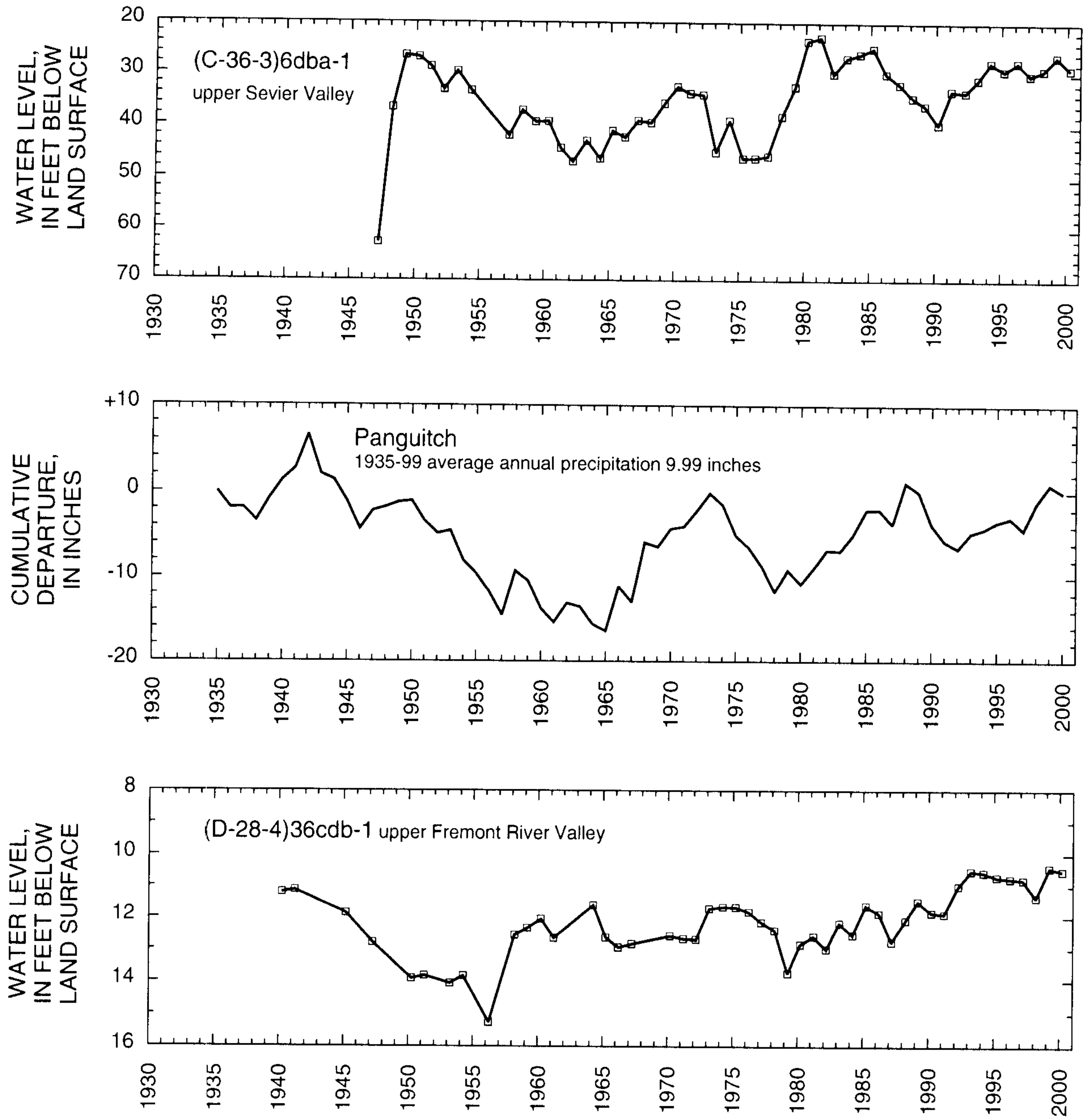


Figure 57. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

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